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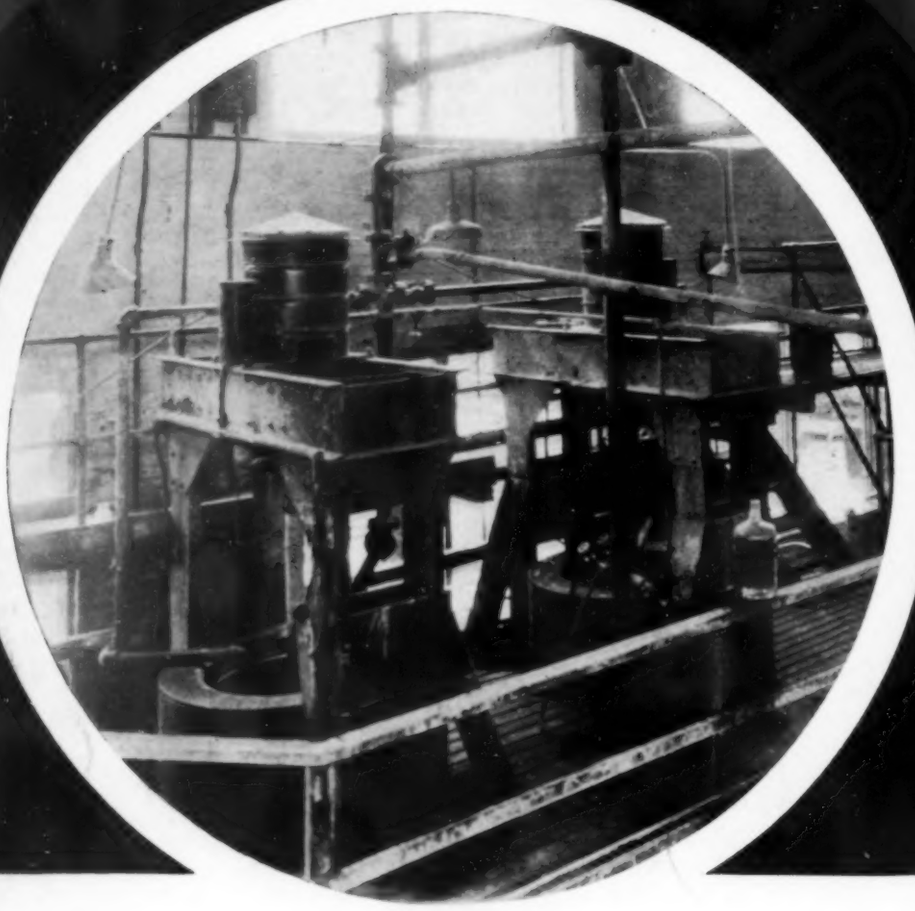

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CHEMICAL & METALLURGICAL ENGINEERING

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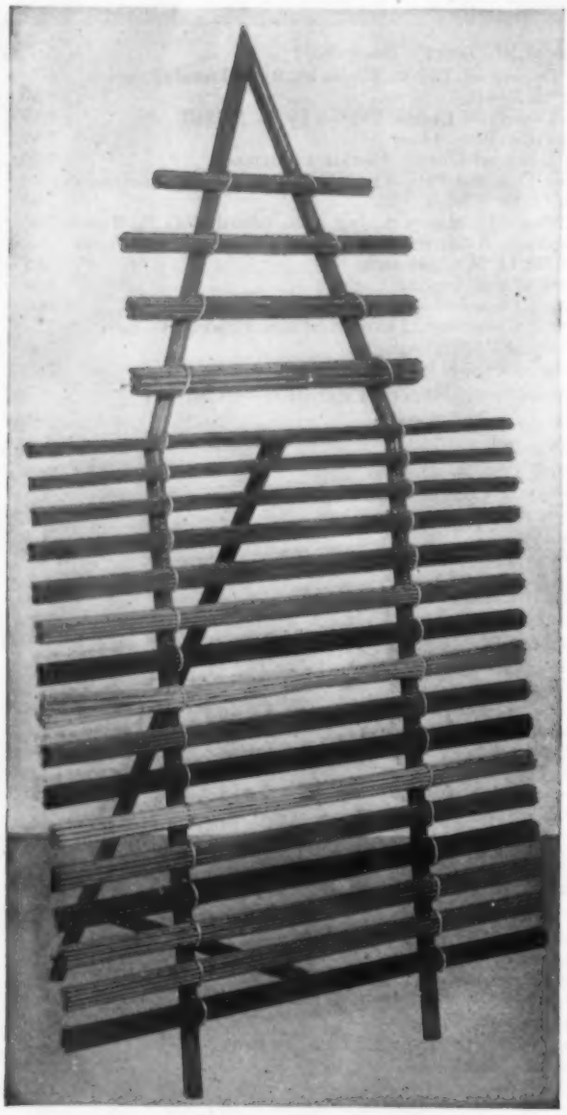

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CHEMICAL & METALLURGICAL ENGINEERING

H. C. PARMELEE
Editor

Volume 34 — New York, December, 1927 — Number 12

Continuing Prosperity for American Industry

PRESIDENT COOLIDGE'S annual message to Congress may have proved disappointing to the special pleaders, but to those who look to the general good of industry, it was a most reassuring document. Today's extraordinary prosperity is well founded. To preserve and strengthen it is an opportunity and an obligation for Congress. It is likewise an individual responsibility to which the President has aptly referred: "If the people maintain that confidence which they are entitled to have in themselves, in each other and in America, a comfortable prosperity will continue."

JUST what has brought about this happy condition and how may its permanence be assured? Production and distribution are at high levels. There is little or no unemployment. For all legitimate industrial operations there is an abundance of credit at favorable rates of interest. Prices are relatively low and the general volume of business is increasing—striking proof that values are not inflated and that buying is for consumption and not for speculation. Those parts of industry that have lagged in the general advance have not proved a serious detriment.

BITUMINOUS coal, textiles and lumber are industries that are making progress in the solution of the basic problems which have handicapped them in recent years. A temporary slowing down of the automobile industry that has had its reflection on such products as steel, rubber tires, leather and paints promises shortly to be remedied. Only the psychological uncertainties of the political situation remain to plague us and their effects may largely be offset by constructive action on the part of Congress.

THE tax revision bill offers Congress its immediate opportunity to contribute a sound legislative measure that will help to make permanent our present prosperity. The seasoned advice of the Secretary of the Treasury, in which the President whole-heartedly concurs, appears to be the safe course of conservative business. Greater reduction made at the peril of a deficit would be a temporary gain that might be more than wiped out by the increased rate of interest resulting from damage done to the national credit. The constructive economy that has come to be associated with the present administration is more than a shaving of bureau estimates. It is a shaping of the national economy, the drawing of a balance sheet for intelligently budgeting the fiscal affairs of the nation.

THE problems that Congress is facing are matters that concern industry, for they are forward steps in the slow process of economic growth. Our present prosperity, as Secretary Hoover pointed out most succinctly in the annual report of the Department of Commerce, is not merely a temporary upward swing of the business cycle, but is the accumulated result of general and permanent progress. We may face the future with confidence if our present problems are squarely met and rightly solved. In fact, progressively higher standards will be reached in 1928 if we look to the efficiency of our production and distribution processes, improve our educational standards and maintain a position of leadership in industrial research.

An Impetus for Nitrogen Research

MUSCLE SHOALS, the perennial feature of presidential messages is gradually being relegated to the less important position it deserves in national affairs. But something of the magnified significance that has kept it in the political arena for the past ten years, is apparent even in President Coolidge's recent comment. In spite of the clearer recognition of the power phases of the project, there is still the dedication to agriculture and the parting reference to fertilizer manufacture as a contractual obligation in any sale of the property. Fortunately, however, as the technological limitations of the plant and process are better understood, an impetus is given to the necessity for further research in nitrogen fixation. From our point of view no better disposal could be made of the proceeds from the sale of Muscle Shoals and it is only to be regretted that such a plan did not have adequate consideration in the early years of discussion. A research program begun on such a scale in 1920 might have meant more to agriculture and the national defense than a score of Muscle Shoals projects.

Lessons in Economy for the Chemical Engineer

DURING THE WEEK of December 4, both the mechanical and refrigeration engineering societies met in New York not only to learn what their members had to tell at the annual meetings of the associations, but to absorb as well the lessons in economy which were so amply demonstrated at the Power Show.

While these lessons were aimed primarily at those gentlemen whose chief interest is to provide the energy behind the wheels of industry, why less at their chemical brethren? If these latter care little about super-power, they substitute an engrossing attention to steam for process.

The most apparent factor in the new power era is economy—and what is more to be desired in the process field?—economy as the result of applications of high pressure in steam generation and in the use of human agency. Automatic control has become a by-word.

In steam generation, a tendency which can not be overlooked is that toward the use of water-cooled furnace walls to permit of higher temperatures than have been possible heretofore. Gun-sprayed refractory coatings are now usual for fire-brick lining. Air preheaters, economizers and feed water heaters are more efficient and more numerous than before. Burners for pulverized fuel and oil have been improved. Stokers have been simplified. And all this in order that boiler pressures of 350 pounds may be, with economy, considered low. One manufacturer, at least, has had the hardihood to abandon the time-dishonored rivet, and has appeared with a welded boiler drum. Others have turned their attention to forged alloy steels for valves and fittings. And legion are the names of those whose controllers and recorders take mechanical operations out of the hands of fallible humanity.

It seems a fitting end for a year of prosperity and improvement, almost without exception throughout industry, that the developments in this basic service field of power, should have been brought under one roof at this time, not only for the enlightenment of those most directly concerned, but as well, for all engineers. To those of its readers who did not attend, *Chem. & Met.* suggests that the approaching New Year is an excellent time to make one resolution which can be kept—to spend at least a little time at the seventh Power Exposition in 1928.

An Offsetting Advantage of the International Cartel

THERE has recently been much talk as to the dangers to American industry through the development of foreign cartels and international trade agreements. Some such hazard may and probably does exist if American business is not planned and carried forward on the most efficient technologic and economic basis, but there is an offsetting advantage to American industry in the development of these foreign monopolies or trade agreements that is often overlooked.

This advantage comes from the fact that these foreign trade monopolies are created primarily in order to increase the price which can be asked for a commodity. The International Steel Cartel had as one of its first actions the establishment of a higher price for steel. The recent international agreement among sugar producers has a similar motive. This agreement appears to give the Cuban producer assurance of about one cent per pound greater price on raw sugar and consequently will have a corresponding influence upon the price of sugar in the United States markets. If Louisiana cane sugar producers can get a cent a pound more for their product than has been possible during the last few years they are virtually assured a new lease of life. This market advantage together with the improved new grades of resistant cane of high yield afford great promise for the future of the Louisiana sugar industry.

The international chemical cartel begins to assume definite form with the reported signing of the agreement by the British and French representatives and the alleged division of the world market for dyestuffs. The earlier feeling of alarm engendered in this country, however, is gradually being tempered by the view that perhaps, after all, the cartel movement will help the American industry by raising prices. Certainly cartel competition can be no worse than the disorganized bidding and price cutting that now exist in some foreign markets.

Other of our industries threatened with foreign competition by organized trade monopolies may yet find a silver lining to the clouds that have been rising on the economic horizon.

Installment Selling of Industrial Equipment

PROFESSOR Edwin R. A. Seligman, the economist, lately delivered a scholarly address in New York in which he summarized an exhaustive investigation made at the instance of the General Motors Corporation. His conclusion that the credit financing of consumption was just as legitimate from an economic standpoint as the financing of production has attracted wide interest in the automotive industry. There is in the distinguished economist's findings an even sounder basis for the extension of consumer credit in the financing of income-producing, industrial equipment.

We are reminded by Professor Seligman that installment credit is as old as the first public works. The building of bridges and highways, irrigation projects and similar public improvements have been made possible by such an extension of credit. We employ installment credit principles in buying real estate or life insurance, for very few homes and practically no insurance policies are lump-sum purchases. For years house furnishings and labor-saving devices in the home, such as sewing and washing machines and electrical appliances, have been sold on a time-payment basis. There is, therefore, nothing new in the principle of installment selling.

The chief advance, for which the automobile industry is largely responsible, is the introduction and development of the finance companies, equipped to serve the specialized banking needs of the industries that sell on an installment basis. This new mechanism was developed primarily to help the manufacturer who wished to sell more goods than could be sold for cash. Installment selling, according to Professor Seligman, has in all cases increased the demand for the product sold. What, we might ask, would contribute more to American industry than a greater demand for automatic control devices or a hundred other examples of efficiency-increasing, chemical engineering equipment?

Henry Ittleson, president of one of the oldest finance corporations in the industrial field, recently told the Association of National Advertisers that at least fifty different kinds of income-producing, industrial and labor-saving units are now being sold in the United States on an installment basis without in any way jeopardizing the principles of sound credit. Progress is being made in many industries in breaking down the customer's natural hesitancy to discard obsolete and inefficient machinery because of disinclination or inability to make a large capital outlay. In such cases there is but one answer. As Mr. Ittleson has well said, "the installment plan means you actually put the machine on the payroll and let it pay for itself out of increased earnings."

The chemical engineering industries appear to offer a real opportunity for the prudent extension of consumer credit. If the equipment manufacturer can keep his capital liquid for direct use in production and can thereby widen his market, he is extending the influence of chemical engineering. *Chem. & Met.* will welcome a discussion from its readers of the possible value, dangers and opportunities in the extension of installment selling to the sale of chemical engineering equipment.

System, Not Mystery, for Piping Identification

IN NO FRIVOLOUS mood but in all seriousness, we recall that famous chemico-biological jingle of poor Willie, the boy who ceased to be through the mistaken idea that H_2SO_4 was H_2O. It was a dreary fate, and the more so for the fact that this conflict between theory and reality is all too common in the tangled and befuddled piping mazes of the chemical plant.

Individual plants have frequently attempted to arrive at usable systems of piping identification. The result usually attained, is that a Babel, not of voices, but of colors, numbers, symbols and all manner of cabalistic signs ensues, to become in the end, perhaps, more trying than the unadorned pipe.

To correct this tendency toward over-elaboration, and to provide a standardized and universally applicable code of pipe identification, usable in every case where any of the thousand and one materials carried in pipes is concerned, the Engineering Standards Committee has prepared a system, described elsewhere in this issue of *Chem. & Met.*, which seems to meet all requirements in a most satisfactory way.

It is the aim of the committee that, through trade and technical associations, industry should, in the absence of a more constructive program, give its sanction to the system. By the division of every conceivable piped material into five major classes, with an easily distinguishable color code for identification and a subsidiary scheme of lettering for further assistance, this system has made possible a simplification which has much to recommend it for safety and increased productivity.

A Nation-Wide Survey of Chemical Opportunities

TWO YEARS ago the New England Council was organized to seek a cure for the industrial ills of New England. Last month under its general direction a thousand business men from the six New England states met in Springfield, Mass., to pool their energies in a mass attack on these economic problems. They met to take stock of the assets and liabilities of New England, to dig up the facts, pleasant and unpleasant, and from such to plan for the future of New England's industries. In all phases of their work it was emphasized that research and exact knowledge, rather than sectional "ballyhoo," was the necessary foundation for rebuilding old industries and attracting new ones.

It was a matter of considerable gratification to *Chem. & Met.* that the regional survey prepared for this magazine by G. J. Esselen, Jr. and W. S. Frost of Boston should be selected by the Council as a means of calling attention to chemical opportunities in New England. Ten thousand copies were distributed to banks, chambers of commerce and industrial executives throughout the country. This testimony to the accuracy and thoroughness of the New England article is likewise evidence of the value and importance of the entire series of regional articles that have been published in *Chem. & Met.* during the current year.

A number of these articles have been reprinted at the request of the authors, or of agencies concerned with industrial development. There have been many requests for all of these surveys and in order to make them available in more convenient and permanent form, *Chem. & Met.* will shortly reprint the entire series. Copies will be distributed at a nominal cost to individuals and organizations interested in the future development of the chemical industries.

With the publication in this issue of the surveys of the Middle Atlantic Seaboard, Virginia, West Virginia and Mississippi, the series is now complete. All sections of the United States have been surveyed by men who are thoroughly familiar with chemical engineering developments within their territories. The series as a whole makes available for the first time a nation-wide survey of the factors that influence the growth and expansion of the chemical producing and consuming industries.

This Industrial Alcohol Plant at Curtis Bay, near Baltimore, Md., is the Largest of Its Kind in World.

In the foreground of this plant of the U. S. Industrial Alcohol Company are to be seen the huge storage tanks for molasses, and at the right center, one of the company's molasses tank steamers is shown discharging her cargo. The fermenter building, still houses and power plant appear at the upper left. It was in this plant that large-scale continuous production of anhydrous alcohol first became a commercial enterprise. Present production is at the rate of about 3,000,000 gal. of absolute alcohol per year.

Anhydrous Alcohol in America

By Lloyd C. Cooley
Chemical Engineer, Swenson Evaporator Company, Harvey, Illinois

EDITOR'S NOTE. *It has been common knowledge for the past few years that absolute alcohol—once highly prized as a laboratory reagent and chemical curiosity—has now become available in tank-car quantities and as such is largely used in lacquer manufacture. But it is not common knowledge that this large scale production by continuous process is the achievement of American chemical engineers. The work on azeotropic mixtures with distillation under diminished pressures is publicly described for the first time in this article by Mr. Cooley, who was formerly on the technical staff of the U. S. Industrial Alcohol Company. It is particularly significant that this development was the subject of a number of patent applications, which were filed several years before the French had announced their solution of this problem through the use of solid dehydrants in a discontinuous process.*

THE AUTOMOBILE is the necessity that has mothered the invention of many products. Such a product is absolute alcohol, rarely mentioned in the popular automotive literature but of increasing importance to automobiles in two applications. The first is of little importance now in the United States but is, in Europe, especially in France, vital in the "carburant national." The second application of absolute alcohol is not in propelling vehicles but in decorating them, namely as a gum and cotton solvent for lacquers. For the first application we shall merely review the fact that the usual alcohol of commerce contains about 5 per cent of water by volume and will not blend itself with hydrocarbons. Hence the strenous efforts in France were not only to produce alcohol as cheaply as possible but also to produce anhydrous alcohol which readily blends with hydrocarbons used in fuel. While not used in appreciable quantities commercially in motor fuels in the United States, extensive experiments have been conducted in this application. As airplane fuels, hydrocarbon mixtures of anhydrous alcohol are an established success. The engines run cooler and can use a higher compression without knocking. The thermal efficiency is sufficiently great in an internal combustion engine to offset the lower heat content of alcohol per unit of weight so that alcohol and gasoline are practically equivalent.

In the United States the second application is of principal importance at this time. Anhydrous alcohol has proved its value as a solvent for nitrocellulose products particularly for the new type of alcohol-soluble cotton now being produced for lacquer manufacturers by the Hercules Powder Company. Large quantities of anhydrous alcohol are used in combinations with anhydrous ethyl acetate for dissolving gums and resins.

Anhydrous alcohol is defined by its principal producer as ethyl alcohol of 99.9 per cent purity by weight and containing less than 0.1 per cent of water. The total daily production of anhydrous alcohol in the United States is in the neighborhood of 8,000 gal. and this is sold at a price which compares favorably with that of 95 per cent alcohol.

The reader interested in the history of absolute alcohol should refer to *Bulletin de l'Association des Chimistes de Sucrerie et de Distillerie de France et des Colonies* for papers published in March and April, 1924, by M. R. Pique, and to an article in the same publication by Mariller in January, 1925. Both articles omit any reference, however, to German patent 287,897 by Kubierschky. This covers a continuous azeotropic process for the use of benzol in producing anhydrous alcohol.

In 1809-1811 Gay-Lussac and Thenard published physico-chemical experiments on the fundamentals of producing alcohol of high strength. Between 1811 and the present time, many patents were granted to inventors for the use of lime and various other solid dehydrants. In others there is record of the use of hydrocarbons and other oils, but no statement as to the strength of the product. Processes using solid dehydrants will be mentioned only briefly here because, while used on a commercial scale, they are inferior from an economical and practical standpoint to processes using the principle of azeotropic mixtures.

Azeotropism may be defined as the property of mixtures to boil at constant temperatures under constant pressure. A constant boiling mixture (or c.b.m.) will distill off vapor having the same composition as the liquid; the components of a c.b.m. can not be separated by fractional distillation.

The first patent for the dehydration of alcohol based on the use of an azeotropic mixture was granted in Germany to Sidney Young, an Englishman, in 1903 (No. 142,502). Young's process involved the fractional distillation of alcoholic liquors without chemical dehydrators. Details will be given later with a comparison with a similar discontinuous process for production of motor fuels patented by Elbridge Stevens, U. S. Patent 1,372,465 and British Patent 159,880, 1921. In 1915, Kubierschky was granted the German Patent 287,897 previously referred to for a continuous process based on Young's method. This process, to the writer's knowledge, has not achieved large-scale production owing to certain inherent defects.

DURING the past twelve years many patents have been granted for the dehydration of the several other alcohols such as propyl, butyl and glycerine and to esters such as ethyl acetate. The processes fall into the following classes as classified by Patart, *Bull. Soc. D'Encouragement pour l'Industria Nationale*, 1924.

1. Solid dehydrants on cold alcohol liquid.
2. Solid dehydrants on hot alcohol liquid or vapor.
3. Action of dehydrating liquids such as glycerine.
4. Distillation under vacuum.
5. Atmolysis; Passage of vapor through porous tube.
6. Azeotropic systems containing alcohol.

During the war, in co-operation with the United

States Government, particularly the Navy, extensive tests were carried out on internal combustion fuels containing alcohol. At the close of the war, the alcohol industry in this country, as in others, was faced with the problem of enormous excess production. Experimental work on alcohol fuels was redoubled. The whole question of alcohol for internal combustion engines is well summed up in a paper by Dr. M. C. Whitaker published in the October 17, 1925, issue of *Drug and Chemical Markets.*

France faced a similar situation as to excess production capacity for alcohol with the additional incentive of high fuel costs due to scarcity of petroleum.

In this country, much work was done on azeotropic mixtures in connection with ester manufacture during the war. It was, therefore, natural that the problem of anhydrous alcohol should be taken up via this route rather than attempting to work out other dehydration methods.

Due to the scarcity of petroleum in France a vast amount of study and experiment has been devoted there to the production of hydrocarbon mixtures containing absolute alcohol. Solid dehydrants such as quicklime, carbide, metallic calcium, and salts such as potassium carbonate have been tried in numerous combinations. The main difficulties are the lack of continuous operation and the losses of product in the troublesome process of recovering residual alcohol from the dehydrants.

Mariller (24) (see bibliography at the end of this article) describes the dehydration by glycerol and glycerolic salt solutions. He points out the thermal inefficiency of column stills and states his desire to start with alcohol of low proof in order to avoid the heat loss necessary for concentration to 95 per cent. However, Mariller's data do not indicate a starting strength of less than 66 per cent alcohol. In processes using glycerine as a dehydrant plate columns of 20 and of 12 plates, in which glycerine passed down against ascending alcohol vapor, were used. The degree of dehydration depends on the grade of glycerine used, as follows: Commercial glycerine (4 per cent water) produces 98.5 per cent alcohol (99 deg. Gay-Lussac); anhydrous glycerine (dynamite grade) produces 99 per cent alcohol (99.2 deg. G.L.); anhydrous glycerine with dehydrating salts produces 99.8 per cent alcohol (100 deg. G.L.).

Alcohol Dehydration with Commercial Glycerine

Deg. Gay-Lussac In	Deg. Gay-Lussac Out	Kg. Glycerine per Hectoliter Alcohol	Reflux-ratio Pure Alcohol in Condensate / Pure Alcohol in Distillate
		Using 20 plates	
96.3	97.7	54.1	0.86
96.0	98.1	49.3	0.84
95.2	97.3	44.0	0.93
94.0	98.0	81.0	1.9
		Using 12 plates	
95.7	98.5	141.1	0.43
81.6	98.1	141.2	0.60
		Using Salts and Glycerine	Per Cent K_2CO_3
66.7	99.5	499	0.75

The concentration of glycerine is carried on in a second apparatus. The process appears to be satisfactory as to cost but H. Guinot (27) states that there exists one very serious defect. The glycerine solution of potassium carbonate, owing to its capacity to dissolve metallic oxides has the deleterious effect of corroding the apparatus.

The Barbet system of vacuum distillation, described in 1924 in Pique's paper (30), was anticipated in the United States by E. J. Winter's patents 1,427,885, 1,427,886 and 1,427,886 applied for in 1918. The fundamental principles of vacuum distillation were published by R. W. Merriman (4), whose results form a table showing the decreasing percentage of water in the azeotropic mixture of alcohol and water with decreasing absolute pressure. Under 70 mm. absolute there is no water in the azeotropic mixture. If a higher partial pressure be used such as would produce an alcohol of 99 per cent then refractionations of the latter would produce absolute alcohol in the residue.

Concerning atmolysis, Patart (32) states that in a paper by Urbain (25) an apparatus is described consisting of a porous tube fitted with a condenser on top, the water vapor passes through the wall of the porous tube and the condensed alcohol is returned to the distillation flask. This was said to yield alcohol of 99.5 per cent.

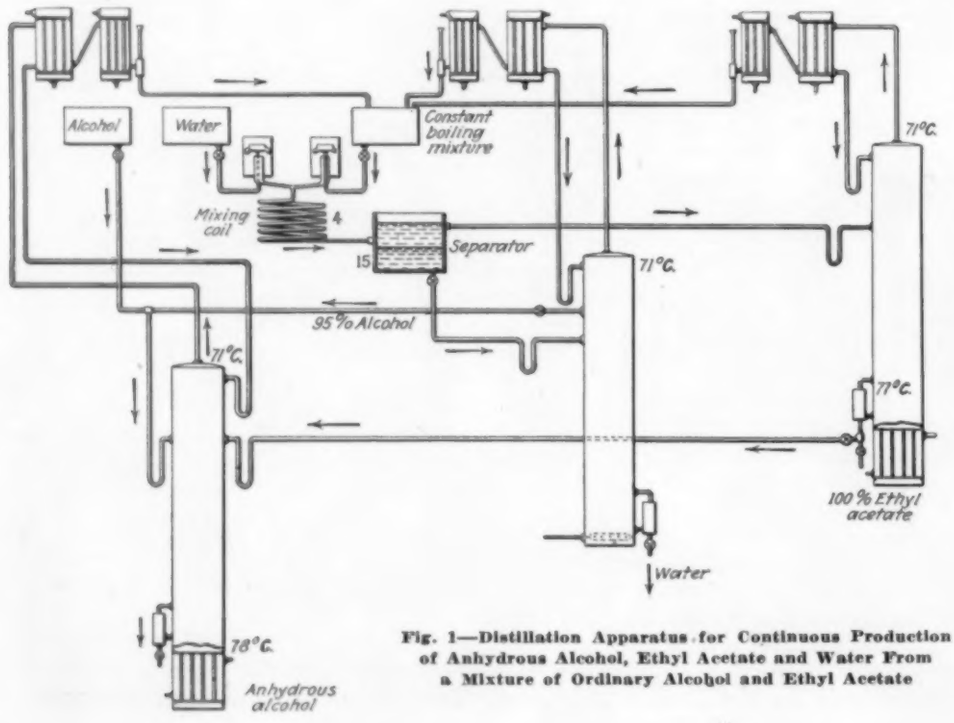

Fig. 1—Distillation Apparatus for Continuous Production of Anhydrous Alcohol, Ethyl Acetate and Water From a Mixture of Ordinary Alcohol and Ethyl Acetate

But by far the most important because the most practical principle of alcohol dehydration is the use of azeotropic mixtures. The vapor pressure of alcohol is reduced in the presence of a third substance such as benzol, or carbon tetrachloride, which mixes thoroughly with alcohol but not with water, while the vapor pressure of water remains unchanged. Therefore, while a mixture of 96 per cent alcohol and 4 per cent water vaporizes without change, the vapors from this mixture in the presence of one of the third substances contain more water than the residual liquid. To quote from Sid-

ney Young's patent, "In a mixture of alcohol, benzol and water where alcohol and benzol distill from the mixture in constant proportions and at a lower temperature than the boiling point of either of the ingredients, the mixture of alcohol, benzol and water starts boiling at a lower temperature than the mixture of alcohol and benzol without water. If a mixture of benzol and 90 or 94 per cent alcohol be distilled there will pass over a mixture of water, alcohol and benzol until at last there remains in the distillation receiver alcohol almost free of water which can be redistilled to produce absolute alcohol. In place of benzol other hydrocarbons can be used, also chloroform, carbon tetrachloride, ethyl bromide, carbon bisulphide, ethyl acetate, ketones and other such substances."

Compare Young's discontinuous process with a similar one of E. W. Stevens, U. S. Pat. 1,372,465, issued in 1921 for a distillation process. The process relates to "a method for utilizing alcohol in the production of motor fuels wherein alcohol is redistilled in the presence of hydrocarbons (benzol or petroleum oils) and fusel oil for the purpose of improving the blending of alcohol and hydrocarbons and for the removal of water contained in alcohol." The inventor claims to have found that distillatory separations become much sharper by the use of fusel oil; this being particularly the case where petroleum hydrocarbons such as kerosene, gasoline, etc., are used. The quantity of fusel oil required is quite small, 0.25 to 1.00 per cent being sufficient. Part of the fusel oil goes out with the final dry alcohol and acts as blending agent. The remainder is redistilled and reused.

SOON after the war came to a close, the U. S. Industrial Alcohol Company started an elaborate program to develop the art of producing anhydrous alcohol and esters. An experimental building of considerable size was erected and provided with commercial size fermenters and stills. Proof of the efficacy of this method of attacking a chemical engineering problem is the number of patent applications and patents which were granted to the men who carried on the investigations. For complete details which are much too involved for the space available here, one should refer to the papers and patents cited in the appended bibliography. One of the most important patents for producing anhydrous alcohols or esters is U. S. Pat. 1,487,182, March 18, 1924, to Prof. W. H. Rodebush assignor to U. S. Industrial Alcohol Company on an application dated April 14, 1921. In this patent several objects are mentioned, but the basic idea was the continuous production of a pure liquid, a constant boiling mixture and water from a mixture of ordinary alcohol and ethyl acetate or benzol. In practice, the c.b.m. produced is an intermediate product and is also separated into its pure constituents.

The apparatus shown in Fig. 1, consists essentially of three fractionating columns, each with partial and final condensers. One column produces anhydrous alcohol at the base, the second 100 per cent ethyl acetate, and the third, water.

Rodebush's apparatus can be used for other alcohols such as propyl and a third constituent not soluble in water, for example, benzol. When using propyl alcohol, the second liquid would be propyl acetate. Closely following Rodebush came Steffens with several patent applications also assigned to the U. S. Industrial Alcohol Company, for processes and apparatus to produce anhydrous alcohol. In fact, the largest commercial application today is operated principally in accordance with Steffens' patents. It is to be noted particularly that Steffens' (as well as Rodebush's) patents are based on exhaustive studies of the art of producing anhydrous alcohol.

The apparatus for Steffens' process illustrated in Fig. 2, consists essentially of two fractionating columns each with partial and final condensers, a continuous separator and a continuous washer together with constant head supply tanks and flow control devices.

Column 29 is the alcohol recovery column. Column 5 is the dehydrating column which is fed through weir box 3 from 95 per cent alcohol suppply pipe 1 and benzol pipe 2. Pipe 2 merely supplies initial benzol and such additional amounts as are required to make up for the slight losses in the process. The amounts of alcohol and benzol fed in are such that in the circulating system, at any time, there would be approximately equal parts by weight of 96 per cent alcohol and benzol but preferably a slightly smaller quantity of the benzol than of the 95 per cent alcohol. The dehydrating column is operated by a closed heater in or connected to the base, maintained at a temperature slightly below 78.4 deg. C. If designed for the purpose, the closed heater can use exhaust steam at one or two lb. pressure. From the base of the dehydrating column anhydrous alcohol flows to a liquid cooler.

Vapors from the top of the column, at one atmosphere pressure have the composition of a constant boiling mixture of 18.5 per cent alcohol; 74.1 per cent benzol, and 7.4 per cent water, at a temperature of 64.85 deg. C. Some of this vapor is condensed in partial condenser 9 and flows back to the top plate of column 5 to supply the necessary reflux for the column fractionation. Good practice would require a seal in pipe 17 and the elimination of valves shown in 17 and 10.

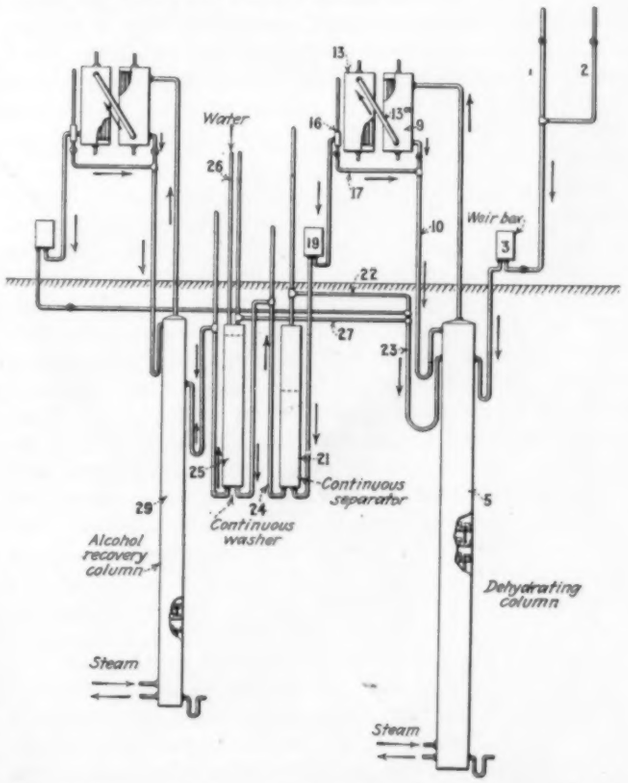

Fig. 2—Schematic Layout of Distillation Equipment Largely as Operated Commercially for the Production of Anhydrous Alcohol

The combined reflux from the two condensers not only provides uniform conditions at the top of the tower but enables the process to be conducted with a comparatively small quantity of benzol so that the condensate reaching the separating chamber 21 will be rich in the water to be removed.

From the partial condenser 9, the remaining vapors flow through pipe 13a to final condenser 13 thence through regulating bottle 16 to weir box 19. From weir box 19, condensed c.b.m. flows to separator 21 which is designed for continuous operation. Two layers are formed in the separator. D. B. Mason of the research department of the U. S. Industrial Alcohol Company reports that the relative quantities and compositions of the two layers formed from condensing the constant boiling mixture depend on the temperature at which the separation takes place. Mason confirms J. Barbaudy, page 1924, Vol. 180, *Comptes-Rendus* (1925), who performed a series of careful measurements on the alcohol, benzol water mixture. At 25 deg. C. the upper layer is approximately 85 per cent of the condensed c.b.m. The upper layer is composed of approximately:

Alcohol	13 per cent by weight
Benzol	85 per cent by weight
Water	2 per cent by weight
The lower layer:	
Alcohol	50 per cent by weight
Benzol	8 per cent by weight
Water	42 per cent by weight

The upper layer is conveyed by a vented pipe 22 back to the dehydrating column 5 while the lower layer passes by a vented pipe 24 to a water scrubber 25. In order to remove the remainder of the benzol, water is introduced into the scrubber 25 by pipe 26 thus producing therein two layers of liquid, the upper layer of which contains the remainder of the benzol. The benzol layer is conducted from the scrubber by a vented pipe 27 to the liquid seal 23 and thence to column 5, while the lower layer, which is dilute alcohol, practically free of benzol, is fed to alcohol recovery column 29. Column 29 is merely a fractionating column, heated with a perforated steam coil, which takes in alcohol at a low proof and raises it to approximately 96 per cent by volume for re-use in the process.

Inasmuch as the alcohol returned to the dehydrating column 5 has a definite composition and temperature and as the benzol has been substantially entirely removed therefrom, the conditions in the upper portions of column 5 are comparatively uniform so far as the character of the incoming alcohol is concerned. Furthermore, inasmuch as the bulk of the benzol is returned directly from the separator to the dehydrating column 5, while the scrubbing is applied to the small portion of the benzol recovered in the scrubber 25, the benzol is returned to the dehydrating column in a drier form than would otherwise be the case. For the same reason less water is carried back into the dehydrating column 5, and there is consequently a more effective separation of the alcohol from the water. By providing a system of this character in which the several parts of the system operate without a great degree of dependence upon one another it is possible to conduct the process with great uniformity and in such a way that the failure of any portion of the system to function temporarily would not interefere with the effective operation of the system as a whole.

The method just described produces anhydrous alcohol containing less than 0.10 per cent of water. The product has been shown by spectro-photographic methods to be chemically equivalent to any alcohol now produced on a commercial scale. The cost of benzol is small. The supervision required is but an occasional notice from one man on a shift whose time is divided among several other stills. Altogether the operation runs very smoothly.

For permission to write about the development of this process for manufacturing anhydrous alcohol and for the use of extensive reference files, notes and translations the writer acknowledges his debt to the management, scientific and technical staff of the U. S. Industrial Alcohol Company.

There follows a list of important references and patents relating to absolute alcohol, omitting most of those referring to use of solid dehydrants. Patents are listed according to date of application except where noted:

(1) 1901 German Patent 142,502, S. Young. Discontinuous Benzol Process
(2) 1902 J. Chem. Soc. (Lond.) 81, 707, S. Young
(3) 1902 Centralblatt I, 1317; II, 103. S. Young
(4) 1913 J. Chem. Soc. *103,* 628-36 R. W. Merriman
(5) 1914 German Patent 287,897, Kubierschky, Continuous Benzol Process
(6) 1918 Four U. S. Patent Applications by Winter, Vacuum Distillation. Granted 1922 as Nos. 1,427,885-8 incl.
(7) 1920 U. S. Patent Application by E. W. Stevens, Distillation Process. Granted in 1921 as No. 1,372,465
(8) 1920 U. S. Patent Application by Rodebush, Continuous Benzol. Granted in 1924 as No. 1,487,182 and in 1926 as No. 1,583,314
(9) 1921 Two U. S. Patent Applications by Steffens, Continuous Benzol. Granted in 1926 as 1,586,727-8
(10) 1921 Two U. S. Patent Applications by A. A. Backhaus, Continuous Benzol. Granted in 1924 as Nos. 1,508,435-6
(11) 1922 U. S. Patent Application by J. Van Ruymbeke. Use of Glycerine. Granted in 1923 as No. 1,474,216.
(12) 1923 German Patent 390,813. Riebeck'sche Montanwerke A.G. Separation of Benzol from Mixtures
(13) 1923 U. S. Patent Application by A. Stevens, Drying Alcohol. Granted in 1924 as No. 1,490,520
(14) 1923 Agriculture et Industrie
(15) 1923 French Patent 561,334-5, Steffens to U. S. I. A. Co., Continuous Benzol
(16) 1923 British Patent 206,747. U. S. I. A. Co., J. S. C. I. *43,* B193 (1924)
(17) 1923 British Patent 211,454 Ricard, Allenet & Cie.
(18) 1923 British Patent 213,984, U. S. Industrial Alcohol, J. S. C. I. *43,* B569 (1924)
(19) 1923 British Patent 213,985-6, U. S. Industrial Alcohol Co., C.A. *18,* 2578 (1924)
(20) 1923 British Patent 214,581, Ricard, Allenet & Cie.
(21) 1923 British Patent 215,716, Ricard, Allenet & Cie.
(22) 1923 British Patent 220,606, Steffens; C.A. *19,* 658 (1925)
(23) 1923 Chimie et Industrie *9* (1), 163. List of French Patents
(24) 1923 Chimie et Industrie *10* (4), 643. Mariller, Ruymbeke Coly. Pr. See also C.A. *16,* 3379; *18,* 375 (1924)
(25) 1923 J.S.C.I. *42,* 201 A. E. and R. Urbain, Distillation and Atmolysis
(26) 1923 Chimie et Industrie Special No. 718-21. P. Loriette. C.A. *17,* 3241 (1923)
(27) 1923 Compt. Rend. *176,* 1623-26. H. Guinot
(28) 1924 Revue del'ingenieur pp. 185-6 March. Spec. No. Pique
(29) 1924 Chem. Age (Lond.) Stinnes-Riebeck
(30) 1924 Bull. Chemistes de Sucre. et Dist., *41,* 337-65, 386-414, Pique; C.A. *18,* 3097
(31) 1924 Zeitschrift für Spiritus Industrie, XLVII Jahrgang 40
(32) 1924 Bull. Soc. d'Encouragement pour l'Industrie Nationale. Patart; C.A. *18,* 2405 (1924)
(33) 1924 J.S.C.I. *43,* 143; Knecht & Muller. Glycerine
(34) 1924 C.A. *18,* 3519. Gav and Massol
(35) 1924 U. S. Patent Application by Clapp, Continuous Benzol. Granted in 1926 as No. 1,586,732
(36) 1925 Chimie et Industrie, Spec. No. 221-33. C.A. *20,* 473 (1926) Gav and Massol
(37) 1925 C.A. *19,* 148 O. Pampe. Also H. Guinot
(38) 1925 Bull. Chem de Sucriere et de Distillerie Jan. Mariller
(39) 1925 Mem. Poudres *21,* 386-395 (1925) P. Loriette; J.S.C.I. *44,* B469 (1925)
(40) 1925 Compt. Rend. *181,* 911-13 J. Barbaudy; J.S.C.I. *45,* B107
(41) 1926 Chimie et Industrie Spec. No. Vol. 16, H. Guinot

Developments in the Braunkohle Industry of Germany

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THE BRAUNKOHLE lignite beds which are found in Middle-Germany, particularly near Halle, Bitterfeld and Magdeburg, as well as in the Rhineland, in Saxony and in the Lausitz, are becoming a great industrial asset to Germany. The total lignite production in 1926 amounted to over 140 million tons. This for the most part was obtained from open-cut working, although there are also a number of underground mines. A characteristic property of German lignite is the high water content which varies from 50 to 60 per cent. For the most part these beds lie 15 to 20 meters from the surface and vary from 18 to as high as 100 meters in thickness. The veins are usually flat and therefore permit open-cut or "Tagebau" workings.

A characteristic method for open-cut work is to remove the overburden in two layers and also to mine the coal in the same way. Approximately one-half of the overburden is removed by what is termed an overhead, or "Loeffel," bagger, the remainder by an underslung, or "Eimer," bagger. In this way is secured a perfectly level working platform for both machines even though the upper and lower surfaces of the overburden and coal bed are quite uneven. By such methods more than 6,000 tons per day is no unusual output for a single mine.

The German utilization of the Braunkohle as fuel may be divided in three methods: (a) the burning of the Braunkohle directly without treatment, (b) the manufacture of briquettes from Braunkohle, (c) low temperature distillation, or carbonization.

As the Braunkohle contains such a high percentage of water and as it would not pay to transport a fuel of such low calorific content over a long distance by rail its utilization without treatment must of necessity occur near the mine, or as far as possible, at the mine itself. This is being accomplished notably at several large electrical power stations built by the well-known A.E.G. The Braunkohle is burned without previous drying on sliding grates of a type developed particularly for this use, or after drying and crushing as pulverized fuel.

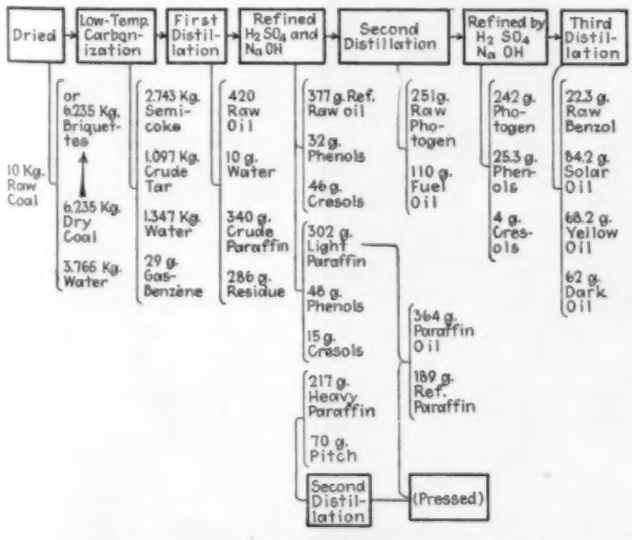

Fig. 1—Flow Sheet of Braunkohle Processing at Edderitz, Germany

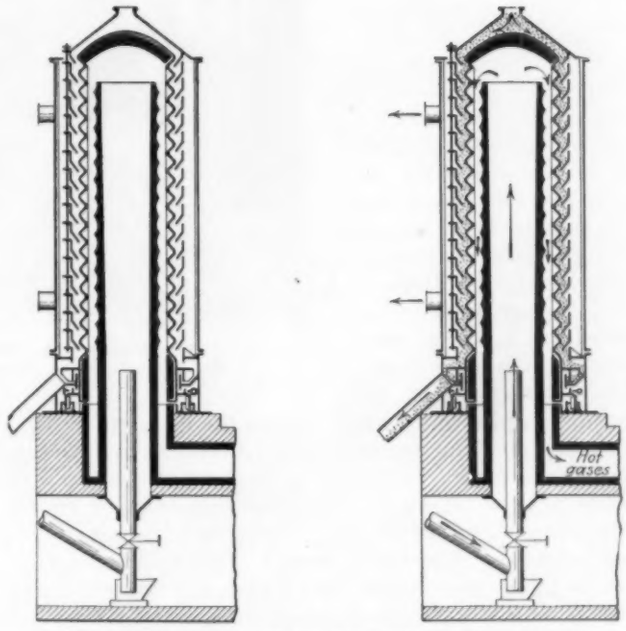

Fig. 2—Diagram Showing Construction of the Low Temperature Furnace

At present the greatest part of the Braunkohle is manufactured into briquettes. The coal is mined, screened and crushed and then dried in rotary tubular steam dryers. In this way a water content of approximately 50 per cent is reduced to that of 15 per cent. Because it does not properly briquette at the high temperature of about 100 deg. C. at which it leaves the dryers the coal is cooled in air-coolers to 30 or 35 deg. and is then ready for the presses. There is sufficient bitumen in the coal to act as a binder and therefore no binding material need be added. The coal is compressed into briquettes under a pressure of 1,600 atmospheres and comes out in a smooth, compact brick ready for use. Each machine is able to deliver, per die, 80 briquettes per minute, the equivalent of 1 centner or approximately 100 pounds.

While the raw coal has a calorific value of 2,600 cal. per kg., the briquettes have an approximate value of 4,800. The ash content is from 5 to 6 per cent. These

briquettes make an excellent domestic fuel and furnish approximately 90 per cent of the fuel burned for household use throughout Germany.

Low temperature distillation of the Braunkohle is perhaps the newest and most interesting method of treating this difficult raw material. The most recent development in low temperature carbonization is that of the Kohlenveredlung A.-G., Berlin. While experimentation on the type of furnace now in use by this concern has been going on for several years, it is only within the last year that this process can be said to have become commercially successful. The furnace, as shown in Fig. 2, may be described briefly as a central combustion chamber much like a Bunsen burner, but having a down draft which carries the flame to an outer cast-iron revolving turret of alternate convex and concave cylindrical form. Surrounding this and about 2 to 3 in. from it, is a stationary cylindrical casing having similar convolutions, and which may be covered with heat insulating material. The finely ground Braunkohle passes between these two cylinders and is carried from one convolution to the other by the motion of the inner cylinder. The retort is thus heated internally and the heat developed by the gas-burner must penetrate into the surrounding jacket of coal. The center of the retort is fitted with a special radiator of refractory material which also serves to direct the heating gas. The furnace is practically a continuous coal distilling device, with the coal flowing in at the top and out at the bottom. The actual time of passage of the coal through the furnace is about 18 minutes. The gases of distillation are drawn off by slight suction through vents in each convolution of the outer cylinder. In this way the gases are not subjected to continued heat and consequent "cracking," but leave the hot chamber almost as soon as generated. The flow of coal through the furnace is regulated by dampers at the bottom outlet. In this way the furnace is always full of coal and the amount that passes through can be accurately regulated. A furnace of this type will distill 100 tons of coal per day, whereas the capacity of the old type furnaces was somewhere between 5 and 10 tons. The products of distillation are as follows: Semi-coke, tar, water (containing ammonia in such dilution that it is not at present recovered) and crude benzol.

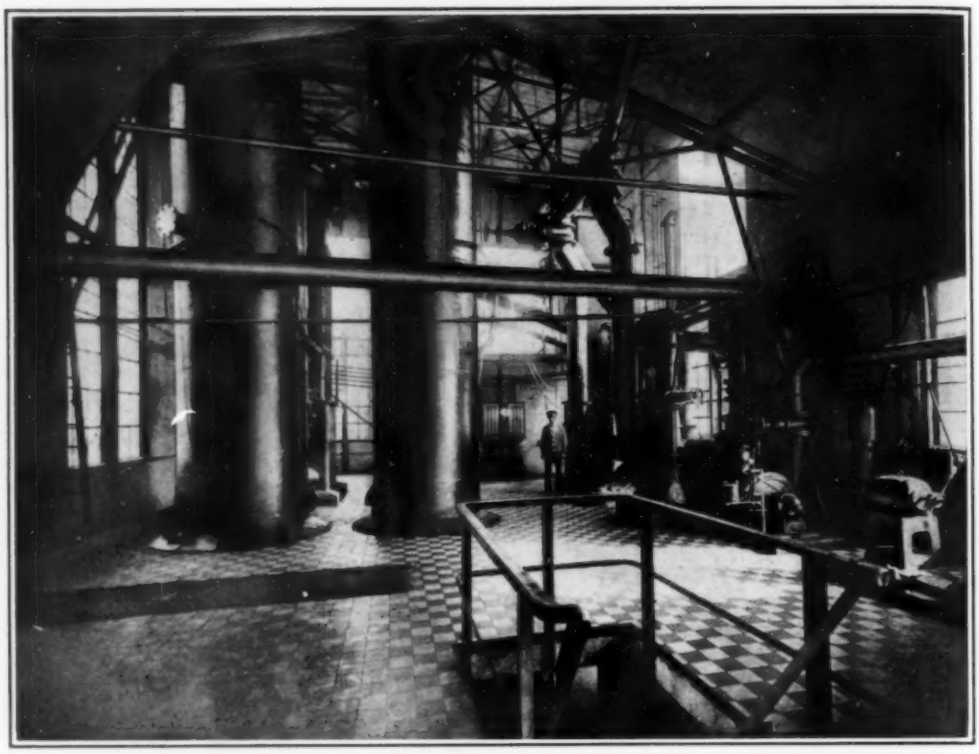

Fig. 4—Showing Part of the Low Temperature Distillation Plant at Edderitz
Tar extractors are situated in the foreground with Cottrell precipitators in the rear

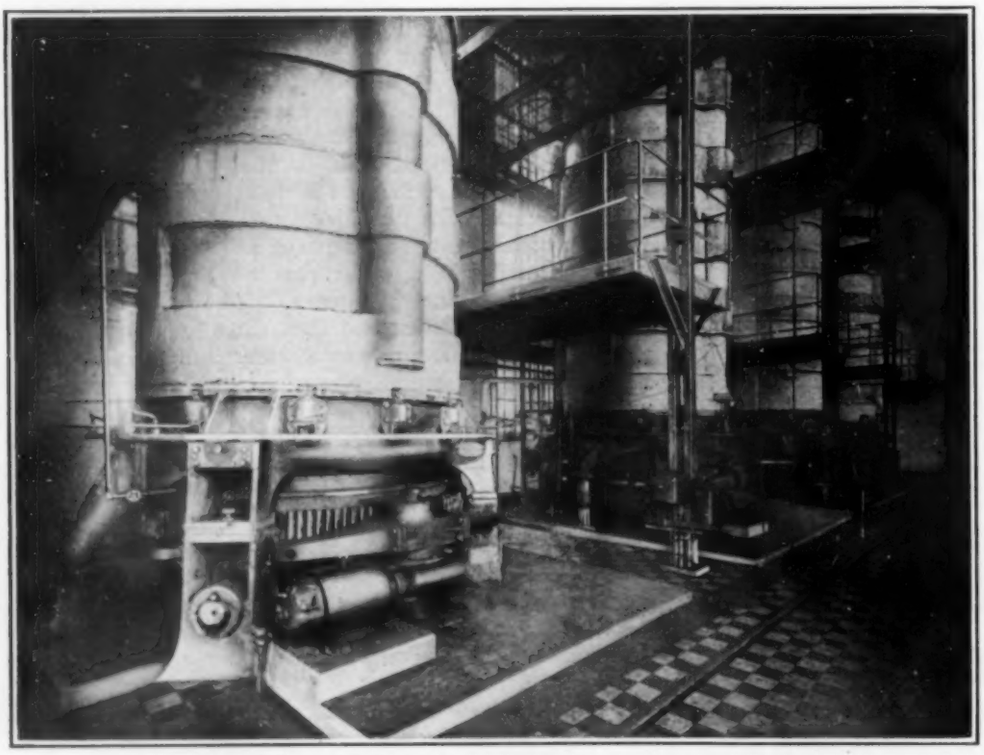

Fig. 3—Four 100-Ton Capacity Low Temperature Furnaces at Edderitz

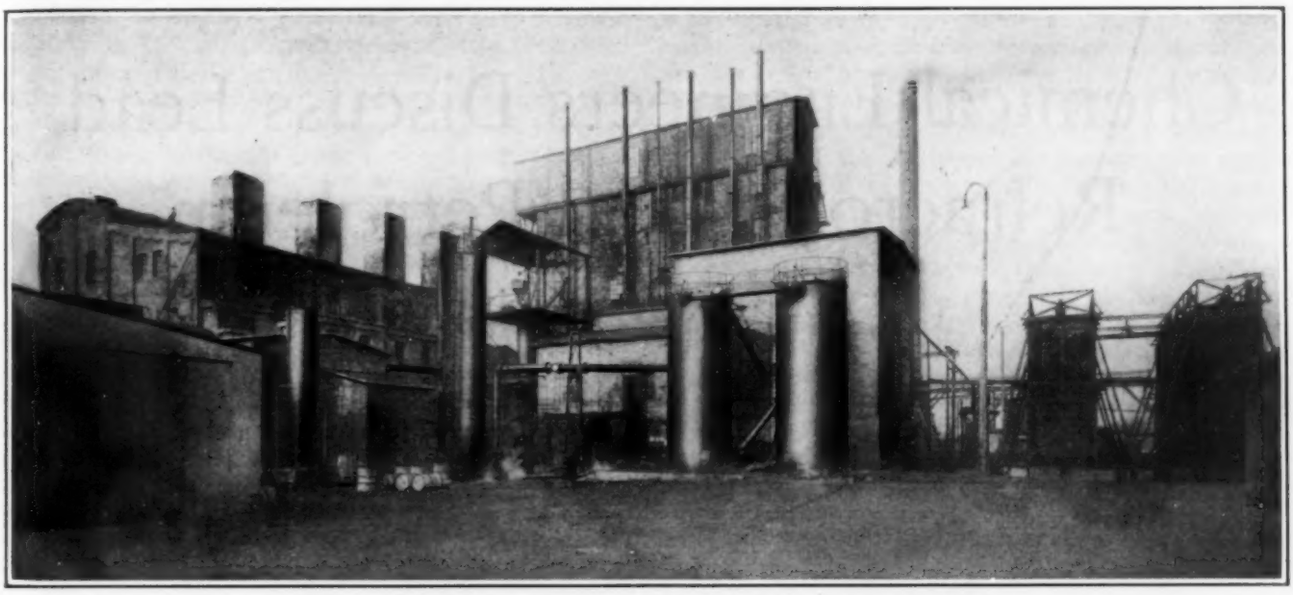

Fig. 5—General View of the Braunkohle Distillation Plant at Edderitz

The gases as they leave the furnace are first cooled in a tubular water cooler, cold water flowing counter-current to the gas. In this cooler most of the tar is precipitated. The cool gases next pass through a Cottrell electrostatic precipitator, where the remaining tar is removed. They then pass through a second cooler in which the water is condensed. From this cooler the gases pass through a benzol absorption tower, where the benzol is absorbed in light paraffin oil. The gases now contain about 25 per cent carbon dioxide and also sulphuretted hydrogen and other sulphur compounds. As only about one-half of the gas generated is necessary for heating the furnace, the remainder can be sold for domestic use. In this case it must first be cleaned of these obnoxious gases. This is done in a very simple manner. The gases are bubbled through water under a pressure of 15 to 20 atmospheres, after which the water is then aerated. Under pressure the water absorbs all of the sulphur compounds as well as somewhat more than 90 per cent of the carbon dioxide. When the pressure is released these gases escape into the air and the water may be re-used.

The tar is redistilled yielding benzol, gas oil, fuel oil and paraffin. It is also possible to manufacture lubricating oils from it. A flowsheet of the distillation process with yields per 10 kg. of Braunkohle is shown in Fig. 1. Braunkohle at the mine in open-cut workings costs approximately 2 marks per ton, whereas the semi-coke finds a ready market at 12 marks. With the tar valued at approximately 80 marks and gas benzol at 280, the value yield from one ton is as follows:

250 kg. semi-coke	3	marks
100 kg. crude tar	8	"
60 cu.m. gas	3	"
2.8 kg. of gas benzol	0.78	"
Total	14.78	marks

From the foregoing it appears that the low temperature carbonization of Braunkohle may yield a considerable profit, and from an economic standpoint, should be an industry well worth fostering.

In conclusion, it is evident that the furnace is the interesting feature of this new low temperature distillation process. The outstanding points are: (1) That it is a continuous process, (2) that the coal is distilled in a very thin ribbon or layer, making for efficient heat transfer, (3) that the gases and vapors are drawn off into cooler compartments almost as soon as generated, (4) that the tar yield is high and of good quality, (5) that the semi-coke is granular, easily pulverized, quickly ignited and burns with a relatively long blue flame because of some 10 to 15 per cent residual gas content. That the furnace is commercially successful in brown coal distillation is evidenced by the fact that there are approximately 31 now in use or being built. From personal knowledge of the brown coals of the North Dakota region, the author is convinced that this furnace will work well with these coals, when allowances are made for the difference in characteristics; and it seems reasonable to anticipate that other lignites and, under modified conditions, even semi-bituminous coals, may yield also to the process.

Manufacture of Formaldehyde by Oxidizing Hydrocarbons

High post-war prices of formaldehyde (£130 per ton in 1921) led the British Chemistry Research Board to undertake experiments on the production of this chemical by oxidation of hydrocarbons. The results of the investigation are now available through "Special Report No. 1—Chemistry Research," which summarizes the the work officially as follows:

> The experiments have been successful in showing how formaldehyde can be made in the form of a dilute solution; they have not, however, led to important commercial results in view of the greater success of the manufacture of methyl alcohol from mixtures of carbon monoxide and hydrogen, which has been one of the causes of the reduction in the price of formaldehyde to its present value of £40 per ton. Nevertheless, the Board thinks its desirable to place all the data on record, particularly as useful information has been obtained in connection with the concentration of dilute formaldehyde solutions.

This document is most readily available in the United States by purchase, at 1s, 9d per copy, through the British Library of Information, 44 Whitehall Street, New York City.

Chemical Engineers Discuss Lead, Refractories and Petroleum

Editorial Staff Report

SPIRIT of St. Louis assumed a new significance to nearly 200 members of the American Institute of Chemical Engineers who enjoyed the hospitality of that city during the twentieth semi-annual meeting, Dec. 5 to 8. Indicative of this "spirit" is the recent subscription, by local business men, of $1,000,000 for a program of research to direct the city's industrial growth along sound economic lines. The home of about 200 companies producing chemicals and pharmaceuticals, and eleven clay-products plants, St. Louis offered much of interest to the visitors in addition to the great lead and ceramic industries which were formally visited. The sessions of the Institute were featured by three symposia, on natural gasoline, refractories and lead.

Opening the session on natural gasoline, B. T. Brooks, presiding, introduced Stewart P. Coleman, who spoke on "Recoverable Hydrocarbons from Natural Gas and their Relation to the Composition of Commercial Motor Fuel." This paper reported a series of tests run by the Humble Oil & Refining Co., in which the butane content, and hence the vapor pressure, of a number of shipments of gasoline was varied over a considerable range, and the corresponding effect on evaporation losses during shipment, storage and handling was carefully noted. It was found that over a range of gasoline vapor pressure up to 400 mm., the rate of change of evaporation loss is substantially linear with vapor pressure. Over the entire range a semi-logarithmic relation holds, so in either case, given the loss corresponding to one known vapor pressure, the entire loss-vapor pressure relationship may be predicted for the conditions in question. The author's recommendation was that hydrocarbons higher than butane should be recovered as motor fuel. The proportion of butane recovered should depend upon the composition of the gas, the relative value of butane as fuel gas or liquid motor fuel, the cost of recovery and the relationship existing between butane content of the final motor fuel blend and evaporation loss. The relationship between evaporation loss and vapor pressure must be worked out for each set of distribution conditions as met. In any effect to incorporate the maximum quantity of butane into commercial gasoline with minimum increase in vapor pressure all casing-head gasoline added should contain as little propane and lighter ends as possible.

A report on the investigation being made by the Department of Chemical Engineering at the University of Michigan on blends of natural gasoline as a motor fuel, was presented by George Granger Brown. The properties and operating characteristics of various blends of motor fuel, have been examined with special reference to their volatility, power developed and anti-knock properties. The author pointed out that in spite of lowered selling prices the production of natural gasoline has expanded steadily and will probably exceed 1.5 billion gallons for 1927, representing over 11 per cent of the total gasoline production. The results of tests on fuels of varying natural gasoline content clearly indicate the importance of high partial volatility of motor fuels and the value of natural gasoline in improving engine performance and making starting easier. It has been noted that highly volatile fuels will give the best results on engines equipped with unheated manifolds, such as those used in aviation and racing. In motors thoroughly warmed up and operating with the full heat of the exhaust on the intake manifold, there is no noticeable difference in maximum power when fuel sold as U. S. Motor (ordinary) gasoline is used, or any of the more volatile blends of U. S. Motor fuel with different amounts of natural gasoline.

Interesting data on the volatility of various fuels were presented. The tests were made in the laboratory by the "equilibrium-air distillation method" of T. S. Sligh, which consists in vaporizing continuously a certain amount of fuel in the presence of a predetermined volume of air. The author concludes that high partial volatility at low temperatures is very desirable for easy starting and handling of cold motors. Total volatility does not appear

to warrant the emphasis it generally receives, particularly in fuels to be used in modern motors equipped with heated manifolds.

Studies of the anti-knock properties of natural gasoline indicate that natural gasoline in blends with ordinary motor fuel containing up to 40 or 50 per cent of natural gasoline, is in general about 0.4 as effective as an equal amount of benzene and is just as effective as the addition of one-half as much benzene. Studies of the relationship between volatility and anti-knock value show little difference in the anti-knock value of natural gasolines of the same volatility produced in different Eastern or Mid-Continent fields, but the more volatile natural gasolines possess greater anti-knock values.

A plant for the catalytic oxidation of petroleum in the vapor phase which has a capacity of 4,000 gal. of kerosene per day was described by W. P. Bitler and J. H. James. The product of the plant is the material from which the alcohol denaturant known as aldehol is prepared. Formaldehyde is also recovered as hexamethylenetetramine. The authors have demonstrated that by oxidizing three cuts, naphtha, kerosene and wax distillate, they can prepare nitrocellulose solvents distilling through the whole range of "low boilers," "medium boilers," "high boilers," "plasticizers" and "softeners." The plant and its operation will be described in a later issue of *Chem. & Met.*

Reducing corrosion in petroleum distillation equipment by the introduction of alkaline solutions mixed with the charging oil was advocated by Gustav Egloff and Jacque C. Morrell. Extensive tests have shown that corrosion is reduced over 50 per cent by the use of amounts of chemicals that are relatively small in comparison with the quantities required to neutralize all the corrosive substances. The favored point of introduction of the reagent is the charging oil line leading to the dephlegmator or the heating tubes. The water evaporates from the alkaline solution in the dephlegmator, leaves the system with the oil vapors, condenses with the oil distillate, and collects with it in a receiver. The chemical reagent is dispersed in the oil and passes through the heating element to the vaporizing chamber. Details of the design and construction of equipment for the mixing, storage and injection of the alkaline solutions were given by the authors. The relative merits of ammonium hydroxide, sodium hydroxide, sodium carbonate and hydrated lime were discussed. While the choice of the particular reagent depends upon the type of oil and the method of operation, in general it has been found that sodium carbonate and lime are more economical than caustic soda. The advantages claimed by hydrated lime are that the heating tubes are more easily cleaned of coke and a smaller amount of "breeze" is formed.

The second day of the meeting was devoted to a joint session with the American Refractories Institute, the members of which were welcomed by E. R. Weidlein, who then turned over the chair to J. M. McKinley, president of the Refractories Institute. In a brief opening address, McKinley stressed the importance of applying the results of research in refractories. J. D. Ramsay, president of the Elk Fire Brick Company, reviewed the development of the refractories industry in America, pointing out that the period of "good-fellow selling" has been succeeded by an era of research wherein producers must strive for better refractories with longer life. He urged closer co-operation between users and producers, to the end that the latter may know more definitely what conditions their products will be required to meet.

Stuart M. Phelps, of the Mellon Institute, outlined the many avenues of refractories research which are being explored, from the purification of clays to the service record of brick. Chemical methods for the removal of iron are being investigated as a substitute for weathering. Another suggested method was the oxidation of iron to the magnetic oxide and subsequent separation by magnetic methods. Flotation methods can be applied to some clays. The interesting possibilities of chrome brick, of which the chief weakness is susceptibility to thermal shock, were discussed. Studies of various methods of grinding have established the desirability of angular grains, rather than the rounded grains produced by the usual wet mills. Interesting data were presented showing the effects of various gases on refractories, sulphur dioxide having been found to increase the crushing strength of magnesite and chrome brick 30 and 7 per cent respectively, suggesting the possibility of introducing this gas during firing.

R. K. Hursh described a laboratory furnace designed for testing fire brick under operating conditions. The test samples are used to line a rotating furnace, into which discharges a stream of molten slag, melted by a gas blast burner, duplicating the erosive action of normal operation, while the temperature gradient through the brick and other test conditions are carefully controlled. Slides showing the behavior of different refractories under the action of corrosive Illinois coal ash were displayed.

A comprehensive survey of the possibilities of aluminous refractories was presented by George A. Bole, of Ohio State University. The diaspore clays, which shrink, due to the inversion of diaspore to alpha corundum which has a higher specific gravity were discussed, with the interesting possibility of developing a catalyst which would hasten the formation of beta corundum, the specific gravity of which is almost equal to that of diaspore, thus eliminating shrinkage. Cyanite as a

source of mullite refractories was described as most promising, particularly to meet the increasing demand of electric furnace users for a combined heat insulator and refractory. The possibility of using stable dolomitic clinker as a monolithic basic lining for small furnaces and for cement in large linings was suggested, since this material has been found to contain di- and tri-calcium silicate, two of the constituents of portland cement.

M. E. Holmes outlined the manufacture of dead-burned dolomite for basic steel open hearth linings, describing extensive laboratory tests whereby the range of composition of stable clinker was definitely located in terms of per cent Fe_2O_3, SiO_2 and dolomite. Having established the "stable" field (between the "dusting" field and the "slaking" field) between 5 and 11 per cent SiO_2 and up to 12 per cent Fe_2O_3, attempts were made to produce stable clinker in this field in the plant. The addition of soda ash was found necessary to produce a stable clinker under large-scale conditions. It was also found that the soda ash increased the density of the clinker and in addition, reduced stack losses enough to pay for itself.

In the symposium which followed the formal program R. A. Sherman discussed the tendency to replace refractory boiler settings by water-cooled walls, pointing out that the failure of manufacturers to produce refractories capable of withstanding the severe conditions of modern boiler practice has cost them a large part of this business. Gustav Egloff enumerated the qualities required of refractories for petroleum stills, weighting non-spalling quality, uniform size and ability to retain rigidity as more important in this case than refractory quality. J. C. Olsen recalled promising results in decreasing the corrosive action of ash by introducing lime with powdered coal boiler fuel.

G. W. Thompson presided over the symposium on lead on the morning of Dec. 8. George O. Hiers reported the results of varied tests on the physical properties of very pure lead, compared to ordinary chemical lead and southeast Missouri desilverized lead. Comparatively large quantities of the pure lead were prepared for the purpose of these tests by electro-deposition, using every precaution to prevent contamination. Yield point, tensile strength and Brinnell numbers were higher for castings of chemical lead than for the pure metal or the Missouri samples. The safe limit of length for a lead pipe of uniform cross-section supported freely in a vertical position from the top was set by the speaker at 71 ft., at 25 deg. C., allowing a factor of safety of 5. Elaborate tests of samples under continuous load and subjected to repeated heating and cooling also indicated the superiority of chemical lead. Pure lead, however, showed somewhat more resistance to corrosion in hydrochloric acid, sulphuric acid, and Heller's solution (40 per cent lead acetate and 10 per cent nitric acid.) The speaker suggested that the copper present in chemical lead may account for the marked increase in strength chemical lead shows over very pure lead and suggested the hypothesis that copper may inhibit grain growth.

The "use of lead compounds in rubber manufacture" by J. R. Sheppard discussed the stress-strain curve of rubber and the effect on it of fillers, time of cure, temperature and the addition of accelerators. Litharge as a compounding ingredient was discussed in detail, and the mechanism of the accelerating action of litharge by the formation of the polysulphide and free active sulphur was described.

A. E. Marshall prefaced his paper on the use of lead in sulphuric acid manufacture by an interesting sketch of the development of the acid manufacturing processes from the Alchemical method of roasting copperas to the utilization of lead chambers in 1746, since which time the development of the art is part of literature. The first use of lead chambers in America was made in 1793 by John Harrison of Philadelphia who, in 1807, offered "rectified" acid at $300 per ton. Of the 7,000,000,000 tons (50 deg. Bé.) annual production of the United States, approximately 75 per cent is derived from lead chamber plants. About 100,000, tons of lead are used in the chambers, towers, coolers, pipes, etc., by the plants producing this acid. The statement of old chamber operators that the chemical sheet lead of 30 years ago lasted two or three times as long as modern chambers probably rises from the fact that the operating chamber space of 30 or 40 years ago averaged between 20 and 25 cu.ft. per pound of sulphur compared with 4 to 12 cu.ft. today.

In a second paper on "The Use of Lead in Processes Employing Sulphuric Acid," the same author compared the merits of lead lined and "lead coated" apparatus. The difficulties of "burning" a satisfactory lead lining in various kinds of special equipment were mentioned and attempts of various manufacturers to produce a bonded lead lining on iron and steel were outlined. In some cases the shell is tinned, flow-coated with a special solder and the lead lining fitted and heated to a point where the solder melts. In the Zeitler process, the same principle is used with the addition of a tinned wire mesh liner which is riveted to the shell and serves as a reinforcing member in the lead. Another method is based on the use of special flux, after the application of which the shell is dipped into molten lead. Bonded lead linings are giving satisfactory service in vacuum evaporators.

The use of lead in mechanical engineering practice was discussed by Owen W. Ellis who tabulated the relative density, hardness, plasticity and tensile strength of the commoner metals. By dividing the limit of proportionality of lead, in lb. per sq.in. by density, in lb. per cu.in., the speaker arrived at the "specific limit of proportionality," giving 40 ft. as the maximum length of a piece of lead of uniform cross section which could be suspended without fear of its creeping. An interesting point in connection with the plasticity of lead which is of some importance in connection with the design of pipe joints, was discussed. Whereas the limit of proportionality of the metal is as low as 200 lb. per sq.in., yet under certain circumstances it may apparently be raised. This is so because the compressive stress required to cause its plastic flow is raised as the ratio of the initial area under compression to the thickness of the metal is increased. This can be explained by assuming that the friction between the surfaces of the metal under compression and the methods by means of which compression is applied prohibit the free flow of the metal until loads well in excess of the normal limits of proportionality have been reached. Thus, in the case of wide gaskets of thin sheet lead, compressive stresses of the order of 3,200 lbs. per sq.in. at least, must be applied if flow of the metal in the joint is to be guaranteed. Various binary and ternary alloys of lead were discussed with particular reference to their physical properties.

Rather convincing laboratory evidence of their contention that filter aids function not merely by increasing the porosity of the filter cake, but also by virtue of their

adsorptive activity was presented by H. L. Olin, N. A. Skow, and Louis Zapf. The addition of supposedly inert filter aids such as fullers earth, Darco, Filter Cel, Super Cel, peanut-hull meal and Norit, causes an increase in the hydrogen ion concentration of colloidal solutions, due to adsorption by the filter aids. Determination of the polarity of filter aids when suspended in water and of their adsorptive capacity for such organic colors as benzopurpurin, basic fuchsin, acid fuchsin, methylene blue, etc., showed that adsorption takes place only when the adsorbent carries a charge of sign opposite to that of the substance adsorbed.

Factors in the Design of Heat Transmission Equipment*

By W. K. Lewis

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HEAT transmission equipment represents an important item of expense in natural gasoline plants. Designing engineers have frequently found it difficult to correlate test data with results predicted on the basis of formulas which are known to be dependable under other conditions. In consequence, design has had to be based largely on empirical rules, applicable only under limited conditions. This is particularly unfortunate wherever the designer is anxious to get the best possible correlation of plant elements from the point of view of economic balance. During the last few months certain factors have been brought to light in other fields which undoubtedly play an important part in natural gasoline technique. It is the purpose of this paper to call attention to these factors, in the hope that an appreciation of them may help engineers in this industry in the interpretation and utilization of the data available.

One of the important heat transmission problems of the natural gasoline plant is the cooling of gases so rich in high boiling constituents that condensation occurs during the cooling process. In the past it has generally been assumed that this cooling takes place in two stages—the removal of the superheat, followed by further cooling accompanied by condensation. The first stage involved in general a relatively high temperature difference but a low coefficient of heat transmission, whereas in the second stage the available temperature difference was low but the coefficient high. Furthermore, the total amount of heat removed in the first stage was small and in the second, large. Under special conditions all this may be true, but very frequently it is not, as an analysis of the underlying factors ought to have shown us long ago.

Consider the case of a highly superheated mixture of gas and condensable vapor traveling through a condenser tube, the outside of which is cooled with cold water. Under any normal conditions the thermal resistance between the water and the exterior surface of the tube is low and that of the tube itself even lower. Consequently the inner surface of the tube will be at a temperature very little above that of the cooling water. Now, on this inner wall of the tube there is a relatively stationary film of gas which insulates the wall itself from the main body of the gas. Through this film there is a temperature gradient, and the temperature of the gas in actual contact with the metal wall is that of the wall itself. Obviously, this wall temperature may very well be below the temperature of condensation of the gas, despite the fact that the main body of gas travelling through the pipe is far above its dew point. In such case, condensation will occur on the metal wall. This will coat the wall with a liquid film of condensate, which serves still further to insulate the gas from the cooling water. However, under many conditions, the resistance of this liquid film is low in comparison with that of the gas film, but whether this be true or not, condensation will occur and the liquid will exist whenever conditions are such that the temperature of the inner surface of the pipe wall is below the dew point of the gas. In other words, condensation of a gas can start long before the gas as a whole has been cooled down to its dew point.

That this sort of thing occurs has recently been demonstrated experimentally by a number of investigations. Thus, in the determination in this laboratory of the coefficient of heat transmission between a mixture of air and steam and the metal wall of a pipe past which the mixture was flowing, the mixture had an original dew point of 180 deg. F., the temperature of the mixture even after cooling being, however, 40 deg. higher than this, namely 220 deg. The cooling water temperature was at no point over 120 deg. However, there was realized a transmission coefficient over tenfold what one would anticipate in view of the pipe diameter and gas velocity. Furthermore, water was condensed in the pipe and a stream of liquid flowed from it.

Theoretical analysis of the problem shows that in such case, if one plot the saturation curve with temperature as abscissae and humidity expressed as pounds of vapor per pound of dry condensable gas as ordinates, the path followed by the cooling and condensing gas-vapor mixture should be a straight line, provided conditions are such that the surface temperature of the liquid film on the pipe existing between the pipe and the gas be constant. It follows from this that the heat absorbed by the cooling medium from the gas per degree of temperature drop of the gas mixture as a whole is nearly, though not quite, constant throughout the range. In other words, conditions are not at all those ordinarily assumed. In the first place, condensation takes place from the start and not merely at the end of the process. Furthermore, the heat lost by the gas in the early stages of cooling is as great as that lost later. Finally, the gas as a whole never becomes saturated until condensation is substantially complete, although during the later stages of cooling it very closely approaches the saturated condition.

While it is plain that these conditions are never perfectly realized in the recovery plant, they are by no means hypothetical assumptions of no interest to the natural gasoline engineer. Thus, in the water-sprayed pipe coolers used in so many plants, the water on the exterior surface of the pipe is cooled to such a degree by atmospheric evaporation that these conditions are at least approximate. It is true that during the early stages of cooling, while the gas is still hot, the water is relatively hot also. However, this is a point at which the temperature difference is large and if the cooling water temperature be assumed constant at a value equal to that at the cold end of the cooler, the error in determining the overall temperature difference is not serious. Furthermore even allowing for the higher temperature of the water at the hot end, pipe wall temperature at that point is likely to be below the dew point of the gas and con-

*A paper presented before the American Institute of Chemical Engineers, St. Louis, Mo., Dec. 5, 1927.

densation therefore starts in at a very early stage of cooling. It can easily be shown that, granting the conditions outlined in the preceding paragraph, the average effective temperature difference between cooling water and gas in such a cooler is the logarithmic mean of the temperature differences at the ends of the unit. There can be no doubt but that the use of the logarithmic mean in this case, employing the actual temperature differences at the two ends, is a far more dependable method of estimating heat transmission coefficients than the assumptions hitherto employed.

It is important to keep a second point in mind. The heat transmitted through the gas film is only the sensible heat of the gas and does not include the heat of condensation of the vapor. The reason for this is that the vapor travels through the gas film to the liquid layer on the surface of the pipe by diffusion in the vapor state, actual condensation occurring on the surface of the liquid film. Therefore the heat of condensation is liberated inside the gas film and hence does not have to travel through it. If now, one grant that the thermal resistances of water film on the outside of the cooling surface, of the metal wall and of the liquid film on the inside are all negligible in comparison with that of the gas film, it follows that one should calculate the heat transmission on the assumption that the sensible heat only of the gas is given up. It is true that the heat of condensation may be far greater in amount than the sensible heat of the gas but it takes care of itself, because there would be inappreciable thermal resistance between the point where it is liberated and the point where it is absorbed in the cooling medium. This does not mean that one can neglect this heat of condensation in calculating the amount of the cooling medium, but only in calculating the necessary surface for heat transmission by the use of the gas film conductivity coefficient. One must also keep in mind the fact that the sensible heat of the vapor is largely conducted through the gas film. Since condensation is linear with temperature drop, it follows that half of the sensible heat of the vapor condensed goes through the gas film by pure conduction. However, in the hotter parts of the system, the vapor diffusion through the film to a degree carries its sensible heat with it. It is probably a satisfactory approximation to assume that the heat thus carried is half the remainder, i.e., that the heat to be removed by pure conduction is three-fourths of the sensible heat of the vapor.

So long as condensation is occurring, the thickness of the liquid film and therefore its thermal conductivity does not vary much with the amount of the condensation, because this thickness is determined by the readiness with which the condensate drains off the surface down to the lowest point of the pipe. Thus it is found that for given conditions of cooling water temperature, pipe size and gas velocity, a gas condensing, roughly, fifteen gallons per thousand, will require double the condensing surface of a far leaner gas producing only a little condensate. Now the fifteen gallons of condensate will weigh approximately 75 pounds and have a specific heat of about 0.6, or a heat capacity of 45 B.t.u. per degree. Granting that three-fourths of this must be transmitted through the gas film by conduction, this means 34 B.t.u. per degree of cooling. Now the non-condensable gas is $1,000/380 = 2.63$ lb. mols. This gas will, in general, have a heat capacity of from 12 to 15 B.t.u. per lb. mol., or 31 to 40 B.t.u. per degree of cooling. In other words, that part of the sensible heat of the condensate which must be conducted through the gas film just about equals the sensible heat of the gas itself and therefore doubles the heat transmission load on the apparatus. However, the heat of condensation of the liquid would be at least equal to the sum of the sensible heat of both gas and vapor. Were this included, it would double the apparent overall coefficient of heat transmission.

It is entirely possible to cool and condense a gas-vapor mixture by the mechanism ordinarily assumed. Thus, if in the early stages of cooling one employ a cooling medium not too much lower in temperature than the gas, i.e., above its dew point, no condensation will occur until saturation is reached. Once the gas is saturated, further cooling tends to keep it on the saturation line. When cooling a hot gas with a cold medium, the condensate is formed at a low temperature and from a cold gas, despite the fact that the body of the gas as a whole is hot. Consequently the high boiling constituents tend to condense preferentially to a greater degree than when the cooling medium employed is higher in temperature, i.e., the condensate contains less dissolved low-boiling components. This is because the differences in relative volatility of components of different boiling points increase at lower temperatures. Thus, all of these factors operate in favor of lower temperature of the cooling medium.

Another important factor the significance of which in recovery operations is often overlooked, is the influence of heat transmission on liquid friction, i.e., on the pressure drop through pipes and conduits. If one determines the pressure drop through an oil heater, one finds that the friction is considerably less than one would be led to anticipate from the ordinary formulas, even though the temperature be averaged carefully both longitudinally and radially. Conversely, in an oil cooler, the friction drop is high. Furthermore, this error can amount to over 100 per cent, i.e., in an oil cooler the pressure may be double what one would anticipate from the ordinary formulas, even allowing for the temperature change as indicated above. This is particularly true, if, as is so often the case, conditions are such that the motion of the liquid in the pipe is viscous in character.

The explanation of these phenomena is undoubtedly the following: If a liquid flowing through a pipe is being heated, the film of liquid immediately adjacent to the pipe wall is the hottest part of the whole fluid. Owing to its high temperature its viscosity is a minimum. Now this film is an exceedingly important factor in determining the friction of the fluid as a whole. Owing to its low viscosity, it serves in a sense as a lubricant to eliminate friction between the core of fluid flowing through the middle of the pipe and the pipe wall. Consequently, the pressure drop is abnormally low. Similarly, if the oil is being cooled, this surface layer is excessively viscous and since, per unit radial thickness, this layer transmits more oil than any other, the pressure drop becomes correspondingly high. This laboratory is working on a theoretical study of the problem and hopes to be able to present a workable engineering solution in the not too distant future. In the meanwhile the factor is one which the designing engineer must not ignore.

It is obvious that real progress in the development of the technique of gasoline recovery must be based upon a quantitative knowledge of the influence of plant conditions upon operating results. It is the conviction of the writer, based upon considerable experience in the industry, that it is most helpful to form the habit of analyzing the process under study so far as possible into its ultimate mechanism and using this visualization as a basis of quantitative interpretation of the results.

Classification of Air-Transported Pulverized Solids

By Harlowe Hardinge
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AIR SEPARATION has to do with the sizing of finely pulverized materials through the medium of air or other gas. The term "Air Separation" is, in reality, a misnomer, since a strict definition of this phrase would mean separation of the material from the air, such as is done in many industrial cases for removal of sawdust, sweepings, and the like from the air, without respect to any sizing action. The subject is better termed "Air Classification," and I will henceforth thus refer to it.

Materials have been separated through the medium of air for centuries. The principle commonly employed was to blow the material to be classified into a chamber in which were located a number of bins. Since the finer particles remained in suspension longer, they were conveyed by the air over to the far bins before they dropped to the bottom, while the coarser particles, having less exposed surface opposed to the air, and consequently less frictional resistance per unit of mass, dropped into the bins nearest the point of entrance. This method of classification is good, crude as it may seem. However, a great deal of space is required when the work is considerable, and the layout does not lend itself to continuous operation with modern methods of grinding and handling large quantities of materials.

The other main principles of classifying by the use of air are through the effect of centrifugal force which increases the apparent specific gravity of the particle, and through the inertia of the particle when forced to change direction under a high velocity head. The classification rate per unit of volume can be increased many times over the straight settlement method described above, where the effect of centrifugal force and inertia can be utilized in classification equipment.

In Fig. 1, the straight settlement principle is illustrated, wherein gravity produces the classifying action, since the entering velocity is so small as to be negligible in this instance. Fig. 2 depicts one method of producing classification through utilizing centrifugal force.

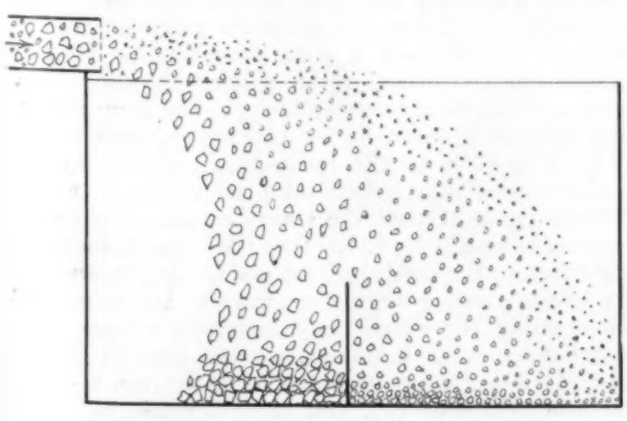

Fig. 1—Straight Settlement Gravity Air Classifier

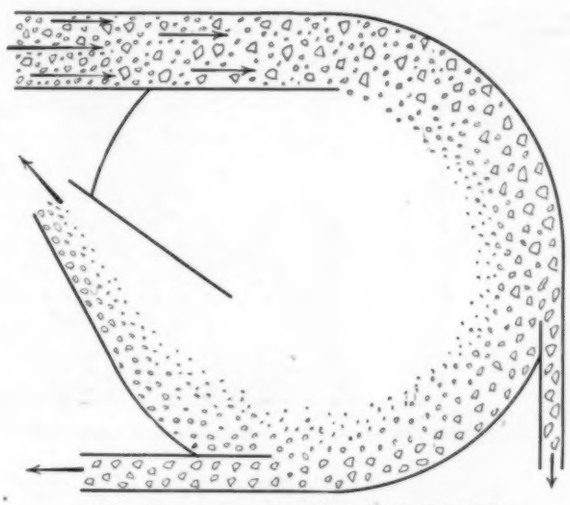

Fig. 2—Elementary Centrifugal Air Classifier

Fig. 3, while somewhat similar in appearance to Fig. 1, utilizes both the principle of inertia and of gravity in that the coarse particles, having greater mass than the fine, will be deflected less by the cross current of air.

It is not necessary to go into greater detail here, as all of the actions so far described are apparent to any engineer. We all realize, also, that the ratio between exposed surface of a solid and its volume increases as the volume decreases. In other words, a 200 mesh particle has many more times the surface exposed per unit of weight or volume than does the 20 mesh particle, and it is this fact that has made the principle of settlement by gravity possible. We all know that a large particle traveling at a high velocity will not tend to change its direction as readily as a smaller particle traveling at the same speed; but what is not so generally known is the fact that air currents have within themselves eddy currents which are produced (a) by friction in the pipe through which the air and material pass, (b) by change in direction produced through going around bends, and (c) through change in velocity on entering a more or less confined chamber. If these eddy currents could be eliminated, or their action predicted, the subject of air classification would be a simple one, but as it is next to impossible to determine accurately by formula what will take place in a given container, it is a matter of trial, as one eddy current sets up counter cross currents and the action is extremely complex.

When we operate under an appreciable velocity head, such as is illustrated in Fig. 2, the eddy currents can be reduced to a considerable extent. In most of the air classifiers used in commercial work today, the principles of gravity and inertia both are employed. A description of the more important types will be given shortly.

The principal difficulties which must be met in design-

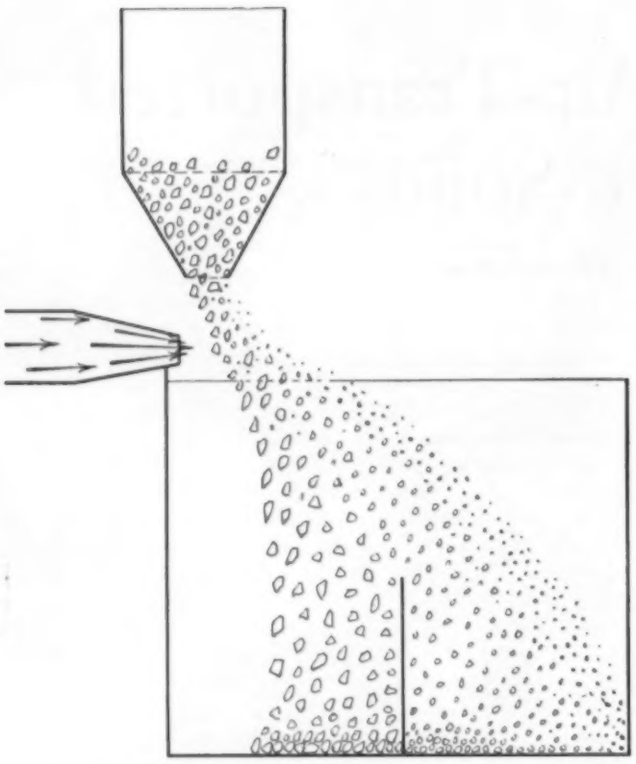

Fig. 3—Elementary Gravity and Inertia Air Classifier

ing and operating a device for the purpose of air-classifying materials are:

(a) Avoiding eddy currents to the greatest possible extent.

(b) Keeping the fine product out of the coarse.

(c) Keeping the coarse product out of the fine.

(d) Making compensations necessary to overcome the change in physical characteristics due to moisture in the air and in the material.

The variation in moisture, with all other conditions held constant, is often sufficient to disarrange the entire operation, since the minute particles of moisture on the material not only change the apparent specific gravity, and hence settling rate, but also act as a binder for aggregates of particles. With an appreciable quantity of moisture, a number of fine particles will cling together as one and will act in the same manner as coarse particles, with the consequent result that very inefficient classification takes place.

The methods used in designing and operating efficient air classifiers have, as prime considerations, positive control of the air currents at all times; proper proportioning of areas and volumes to produce as few cross currents as possible; proper design of all shapes, so that where directions of the air and material must change, as little loss of energy as possible results and no settling of the wrong size of material takes place. Methods must be employed to re-clean the coarse material of any fines which settle out with it, as it is very nearly impossible to operate any air classifier without causing a certain amount of fines to settle out with the oversize. It is equally essential that no oversize beyond the allowable limits, ever go over with the fines. And last, but by no means least, the moisture must be kept as low as possible in order to produce maximum separation efficiency. This can be controlled either by removing the moisture before the material enters the classifier, or by the use of a sufficient degree of heat in the classifier to raise the dew point to a degree where no precipitation of moisture can take place on the fine particles.

There may literally be said to be hundreds of different designs of air classifiers, many of which are quite efficient, but of limited use. I will indicate here the principles of only a few types, and describe briefly their functions and application.

The well-known gravity principle, in which the material-laden air enters a chamber, either through a round pipe or a flared oblong opening is still used; however, with means for creating as uniform an air current through the chamber as is possible. The entering velocity is kept low, so that there will be no appreciable inertia, and all of the classification is done by gravity. The coarse particles settle first and the fines last. The air is then removed at the far end of the chamber and still contains extreme fines which will either be allowed to go to waste, or may be collected through other means such as a bag filter, where the fines remain in the bag and the air passes through. Periodically, the bag must be cleaned, since the collection of fines on the surface gradually causes the filter to become impervious, when all action will cease; but by removing the pressure from the bag and shaking periodically, it is cleaned and may continue in service.

The well-known cyclone collector is often used as a classifier as well as an air separator. The air, carrying the material, enters a drum-shaped portion through a pipe tangent to the periphery of the cyclone at the top. This air must enter at a reasonably high velocity in order to produce the proper classifying effect. Within the separator there is set up a cyclonic action which increases the apparent specific gravity of the particles many times over the actual, and hence they are thrown to the outside and slide along the surface of the drum portion and then of a conical portion, dropping down through the action of gravity to the base and out a bottom discharge. The air and extremely fine particles which were not thrown to the sides are drawn up through an uptake pipe which extends well down into the drum portion, and out of the classifier. If a finer product is desired, a second cyclone may be employed and extreme fines removed, if required, by the means already described. This cyclone classifier is used extensively for the actual removal of particles from the air, without the use of a bag filter, as it is the most efficient device of its kind, consistent with a simple and inexpensive design. It is not, however, an efficient classifier, as fines are also thrown out with the coarse particles, but under certain conditions it can be used with some success for this purpose.

With reference to Fig. 4, we find a variety of air classifier which has met with considerable favor for a good many years, since it employs the principle of settlement by gravity, and in some combinations, by both gravity and centrifugal force, without the use of any outside device to remove the fine material from the air. The material enters a hollow tube at (a) onto a plate (b). This plate usually revolves in order to produce uniform distribution. In flowing off the plate (b) the material passes through the space between the plate and an inner section (c). Large fans (dd), produce a whirling effect on the outside of the casing (c), drawing the air from the casing through the material and on into the outer casing (e) which has considerable volume. The material settles out in this volume and down to the bottom (f) where it is withdrawn. The air then re-enters the inner chamber (c), first being screened by baffles (h), to remove as much of the fines still remaining in the

air as possible. Here it again passes up through the material. The oversize or coarse particles which were not drawn up with this up-coming stream of air through the casing slide on down into the coarse product pipe (g) and out of the system. In other types, a whirling effect inside of the casing (c) also, is produced by a second set of fans revolving in this casing, which throws the coarse material to the side by centrifugal force. This type of classifier is self-contained and requires but a relatively small amount of power, and has met with favor in many instances where a fine, uniform product is desired, either when operating in conjunction with a pulverizer where bucket elevators and other auxiliary apparatus can be employed, or where a product, such as finely disseminated and dried clay, is to be classified for various industrial uses.

Fig. 5 illustrates still another type of classifier, and one which is particularly adapted to use in conjunction with pulverizers, and where an absolutely positive control of the fineness must be maintained at all times. Here the air and material to be classified enter at (a) at the bottom and pass up in the annular space between the outer and inner cone. As there is considerable area between the two cones, the velocity is reduced, and the coarser particles settle out and down into the pocket (b). The balance of the material and all of the air pass on to the top of the outer cone at which point are located a number of twisted flights or tangentially inclined blades which whirl the material and air at this point. This creates a cyclonic action and throws down the coarse particles into the inner cone (c). In most instances the angle of the blades is adjustable to obtain an adjustment in size of the rejected material. The fine particles and air pass up and out of the system at (d). The oversize or coarser particles which settle down to the bottom of the inner cone (c), drop out once more against the upcoming air current from (a), and any fine particles which settle out with the coarse are again swept back up the classifier and are not allowed to drop into the pocket (b); hence the material dropping into (b) is uniform and granular, and the collection efficiency is high. This type of classifier is capable of producing not only a very clean oversize, but an extremely fine product. In some cases where conditions demand, products as fine as 100 per cent through 200 mesh and from 98 per cent to 99 per cent through 325 mesh have been secured.

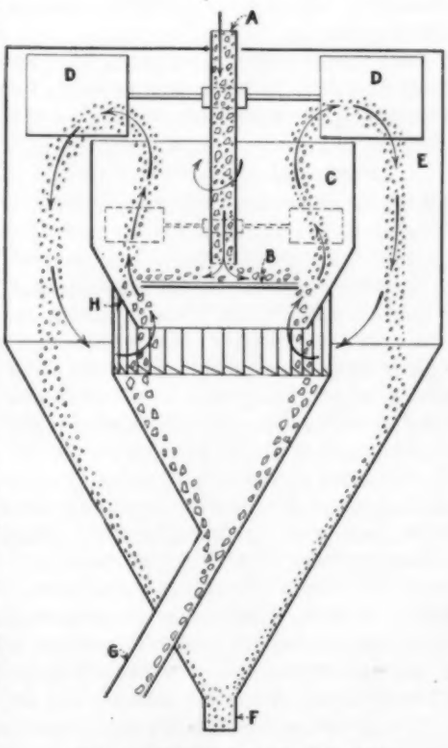

Fig. 4—Modern Gravity Classifier

In conclusion a few remarks concerning design of classifying equipment will not be out of place. The study of air classification in general requires not only knowledge of engineering principles, but is also one involving a great amount of experimentation, as it is mathematically impossible to make predictions as to what can be done, even though all of the conditions possible are given. A few of the more important factors upon which fairly definite figures can be given are outlined below:

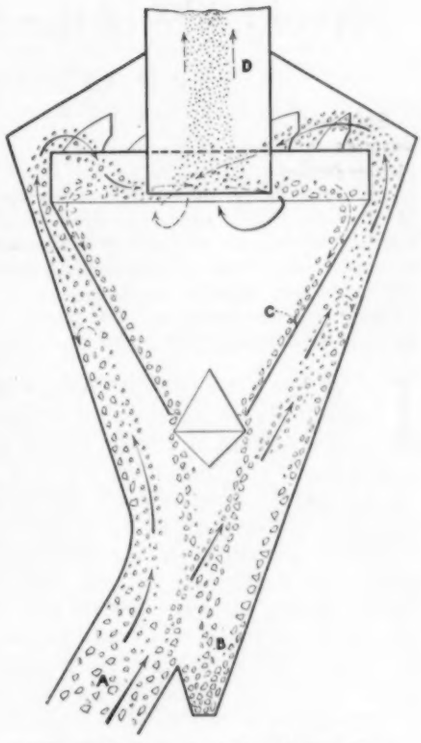

Fig. 5—Modern Centrifugal, Gravity and Inertia Classifier

(1) When material containing particles as coarse as 10 mesh, is to be conveyed by air to the separator, a velocity of 4,000 ft. per min. should be maintained. Where the coarsest particles do not exceed 65 mesh, a velocity of 3,000, and sometimes even 2,000, ft. per min. is sufficient to keep the material in suspension.

(2) It is possible to convey ground materials, at a rate of from 7 to 10 cu.ft. per lb. of material moved, a distance of approximately 100 ft. by the standard exhaust fan designed for such purposes.

(3) Much larger quantities of air per lb. of material are required for classification. The finer the product and the more efficient the classification, the greater is the quantity of air needed. To classify coal when the feed to the separator is from 40 to 50 per cent through 200 mesh, and the fine product desired is 75 per cent through 200 mesh, from 30 to 50 cu.ft. of air per lb. of fine coal are required, depending upon the type and efficiency of the classifier used. To take the same feed and deliver a product of 95 per cent through 200 mesh, from 60 to 100 cu.ft. of air per lb. of fines are needed.

It is readily seen from the above that to convey material takes but a portion of the air and power that is required in classifying. It is also apparent that in both conveying and classifying it is important to avoid sharp bends and excessive velocities, since both cause losses which consume power and produce increased wear on the system at these points, especially when abrasive materials are handled.

The figures given above are rough approximations only, since local conditions and different methods used will alter them considerably. The safest procedure in any case is experimentation. Through operation and test data secured from hundreds of different installations, it has been possible, with a reasonable degree of accuracy, to predict by the use of empirical formulas, what a classifier can do under definite conditions. But to try to work out specific cases through untried devices is physically impossible.

Avoidance of the Obvious

By P. O'TASH
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EDITOR'S NOTE: *An executive in one of our chemical industries wrote the following "sermon" for his own amusement—perhaps as a form of retribution after making some of the mistakes he warns us against. Later the manuscript fell into the hands of some of his associates who proceeded to incorporate it into the prescribed course of instruction for all employees engaged in chemical research and chemical engineering development. Its moral, however, is just as applicable to many other forms of endeavor.*

IT WAS THE PROFOUND NEWTON, whose mental efforts gave us an organized conception of several of Nature's laws, who is reported to have cut two holes in the bottom of his door; the large one for the cat and the small one for the kitten. The mind that mastered the obscure did not protect its owner from a ridiculous oversight of the obvious fact that the cat's child could readily use the cat's door. It is the professor, whose mental capacity exceeds that of the common lot, who looks everywhere for his glasses while they are on his nose. When the affluent research chemist experiences motor trouble on his way to work, he is very apt to raise the hood of the car and dissect the engine. After getting himself thoroughly dirty he examines the gasoline tank to find that it is dry.

To use an Hibernianism, it seems very hard for us to see the thing that is apparent. We seem instinctively to seek the thing that is hidden and, in research, our avoidance of the obvious often makes us choose the hardest road to success. The gasoline automobile did not appear until many centuries after *homo sapiens* had left his home in the trees, but it was some years after the first automobiles were in use before the designing engineers thought to take the whip stock from the dashboard. Eventually the dashboard itself disappeared.

The writers of detective stories frequently develop the fact that the safest place to hide an object is in plain sight. Officers, who search a house for hidden money, may tear the bedding to shreds, rip up every floor board, and excavate the entire foundation but, it is alleged, they seldom look in the tin bucket hanging on the wall.

PROBABLY the greatest task of the industrial research worker or inventor is to avoid this flight from the obvious, the urge for which seems to pervade our minds. In attacking a problem it seems to be a common inclination to try some "new method," overlooking the possibility of a very minor change in an existing process which may serve as well. Possibly this attitude is partly due to the thorough traning in "scientific method," that our research workers acquire in universities. More probably it is simply one evidence of two unfortunate human traits that do not seem to be lost in the process of a scientific education, namely: a *great egotism*, and a *great suspicion*. This great egotism may be expressed for the research man somewhat as follows: "If it is that easy to do, I would have thought of it before." The great suspicion may be similarly expressed: "If it has been published or patented, there must be something wrong with it." Both of these defects, if they do exist, are properly classifiable as the avoidance of the obvious.

Every year between ten and one hundred advanced students in qualitative analysis spend weeks in examining and re-examining a water-white, odorless solution which leaves no residue in a platinum crucible. They are heart broken when they learn that their analytical talent has been wasted on a sample of distilled water. It is hoped that this lesson in the danger of avoiding the obvious may benefit these same men in later years. Certainly the exercise is better for the ego than the solution of the most complex "unknown."

We smile when we recollect that the first steam engines operated on American railroads carried tender boys, whose duty was to throw two valves backward and forward at the same time. Some years afterwards, one of these boys decided to avoid work by tying the two valves together with a strap and attaching them to a synchronized moving part of the engine after which they operated automatically.

IT IS the habit of those who discuss chemical discoveries and inventions to stress the element of the accidental—*vide* the old story concerning the discovery of synthetic indigo in which the chemist was alleged to have accidentally broken a thermometer in the flask, the exposed mercury acting as the required catalyst and bringing success out of failure. The chroniclers of chemical research are not so prone to discuss, as inventions, those developments which are made only after a long period of years and which are so simple in nature as to appear obvious to the later student. Indeed, in smiling at our tendency to overlook the obvious, we should remember that the dumbness of mankind has been judicially noted by the Supreme Court in the following words: "Knowledge after the event is always easy, and problems once solved present no difficulties, indeed, may be represented as never having had any, and expert witnesses may be brought forward to show that the new thing which seemed to have eluded the search of the world was always ready at hand and easy to be seen by a merely skillful attention." But after sympathizing with ourselves for our tendency to seek the hard road, we can nevertheless endeavor to develop that "skillful attention" which may prevent subsequent flights from the obvious.

Lest the writer be accused of "romancing" let us refer to a few concrete illustrations of our great egotism and our great suspicion which hamper us in scientific work.

PAINT removers ordinarily consist of a volatile solvent mixture capable of removing paint, varnish or lacquer. To reduce the volatility, and consequent loss of solvents, some wax is usually added. This wax forms a film over the liquid solvents and thus retards evaporation. In using such a remover a microscopic quantity of wax is almost inevitably left on the clean surface. While the presence of this wax does not interfere with the successful refinishing of the cleaned surface with oleoresinous materials, it is fatal to lacquer. Consequently in thousands of refinishing shops throughout the country, wax-containing removers are being used and the workmen then spend more time and energy in removing, absolutely, any wax that may thus be deposited, than is required to remove the old finish itself. The idea of using ordinary removing solvents without the added wax, and saving an immense amount of valuable labor at the minor expense of a slightly increased evaporation of very cheap materials seems most unpopular.

A year or two ago the United States was deluged with synthetic methanol produced by a new and secret process

abroad. Presently foreign patents issued and American scientists commenced to test the processes described in the patent specifications. Further search in the patent office records indicated a very early patent which, it was stated by some prophetic-minded individuals, was the basic patent on synthetic methanol. A howl of derision arose and our scientific inhibitions caused us to believe: first, "if it was that easy they would have done it before" and second, "since it is a German patent it won't work." It was not for a year or more that any adequate test was made of the process described in this patent and the surprise engendered by the successful working of this old process to produce synthetic methanol has not yet been quieted.

Much time and money was recently spent in attempting to introduce a new liquid in the dry cleaning industry. The virtues of the material were extolled, cleaners were interviewed, research was done—when suddenly someone remembered that the material dissolved artificial silk.

In a chemical plant, a process requiring accurate temperature control suddenly went bad. The staff set about to correct the situation by analyzing materials, searching for leaks, and consulting specialists to determine whether a negative catalyst could be causing the trouble. When all of the imaginable defects had been dismissed some one thought to test the pyrometers.

To prove that there is after all, something new under the sun the "smokador" was recently introduced. For years we have regarded an ash tray as the proper depository for ashes and the cuspidor as a suitable vault for cigar butts and other byproducts of smoking. It was thought that ash trays placed on the floor would be most inconvenient and that cuspidors did not belong on the table. After struggling along in this manner ever since Sir Walter Raleigh made the smoking of the weed more or less socially correct, it finally occurred to someone that the most efficient purpose would be served if the cuspidor itself was extended to table height by a narrow pipe and a bottomless ash tray connected to the top. While such a change may appear obvious, in reality it had escaped attention for a sufficiently long period to warrant respectful consideration as an invention of merit. Many of the most profitable and ingenious chemical discoveries and chemical engineering developments of late years have consisted in combining two processes into a unitary continuous whole, in a manner not unlike the creation of the smoking stand.

Like the tender boy, it may take us a long time to connect cause and effect sufficiently to tie together two parts so that they will coact. In the meantime, however, let us still strive to attack our problems without an airy disregard for the most obvious solutions.

Rubber Covered Equipment in Chemical Industry

By A. H. Bresser
Berlin, Germany

THE USE of rubber covered apparatus in the chemical industries was described in a number of accounts in *Chem. & Met.*, 1926, Vol. 33, No. 10. These referred, however, only to American work. An account is therefore given here of a development which has recently achieved great success in Germany.

In contrast to published American developments, the German process is based on coating the articles in an autoclave with a rubber solution, not on electrodeposition of the rubber on the metal surface to be covered. The process is the outcome of work dating back twenty years, but is only now finding successful application. It may now be said of the material that it meets every reasonable requirement that could be asked of a corrosion resisting covering. Of course this statement must be made with certain reservations, which will be discussed presently. The characteristic feature of this process is a kind of chemical combination between the coating and its base, namely the metal surface to be protected. The shape of the article to be coated has no bearing whatever on this. After the coatings have been applied they can be removed only by force, with hammer and chisel, and then not completely. This adhesive property is particularly useful when the rubber covered apparatus is to be used in vacuum or subject to wide fluctuations in temperature. Apparatus covered by this German process can even be used where the treated container or reaction vessel is to be heated, provided the temperature is not allowed to exceed 135 deg. C. It should be noted, however, that temperatures as high as 150 deg. C. can be endured for short periods of time.

The composition of the rubber coating is varied according to the intended use. Behavior toward various chemicals is noted below.

1—The coatings are not attacked by concentrated hydrochloric acid, whether pure or impure, even at boiling temperatures.

2—The coatings are stable toward cold nitric acid up to 20 per cent and sulphuric acid up to 60 per cent. For the hot acids these concentration limits must be lowered accordingly.

3—Hydrofluoric acid, gaseous halogens and oxygen have no effect.

4—The coatings have given excellent service against alkalis, alkaline and acid solutions and organic solutions in general, and are expected to work equally well with lacquer solvents.

As for the mechanical properties of the material, for general use a tough semi-hard grade is entirely satisfactory. Special coatings are being made, however, of such hardness that they can be planed, ground, drilled and polished. The adhesion is so strong that a flat strip coated on both sides can be bent double and straightened again without separation or breaking of the coating. The tensile strength is about 2,000 to 2,500 lb. per sq.in. according to hardness. The elongation is about 3 to 5 per cent. The thermal conductivity is low. A practical evaporation experiment showed the following evaporation values: 25.2 lb. per sq.yd. heating surface per hour; 56.1 lb. per sq.yd. surface per hour.

According to an official certificate of the Institute of Technology at Braunschweig, the adhesion is so strong that in tearing tests separation is not at the interface between rubber and metal; either the rubber tears, leaving a thin film on the metal, or the metal is torn away.

These rubber coatings are remarkably versatile in their possible uses. There is hardly any line of chemical equipment where rubber coating cannot be used to advantage. First cost may seem relatively high, but it is soon compensated by the prolonged service life of the treated equipment.

Removing Hydrogen Sulphide from Coke Oven Gases

By W. Gluud and R. Schönfelder

Gesellschaft für Kohlenteknik, m.b.H., Dortmund, Germany

THE PAPER on sulphur recovery by F. W. Sperr (*Gas Journal*, No. 175, pp. 262-4, Aug. 4, 1926) gives occasion for mention of work done in recent years by the Gesellschaft für Kohlenteknik on removing H_2S from coke oven gases. As is not unusual, this work was done quite independently of the Koppers Co., and without knowing of their investigations. The two studies are fundamentally the same, but differ much in details. From the technical standpoint, we believed that our results are more favorable, particularly when our method of refining the crude sulphur is included in the process.

In both methods, the effective scrubbing liquid is a very thin aqueous sludge of ferric hydroxide. We differ from Koppers, however, in that generally we use the NH_3 of the gas itself (not added soda) to obtain the necessary alkalinity for accelerated transfer of the H_2S to the $Fe(OH)_3$ and for accelerated oxidation of the resulting iron sulphide. This saves the cost of soda, which adversely affects the balance sheet of the Koppers process (loc. cit.). It is true that the G.f.K. process necessitates recovery of the combined ammonia; but the amount is so small, compared to the large volume of ammonia liquor which must be treated anyway, that the operating cost thus added is almost negligible. In order to take advantage of the NH_3 content of the gas, the desulphurizing apparatus must be located between the tar separating unit and the ammonia and benzol scrubbers, not after the latter.

The principle of the process is simple; the H_2S-bearing gas goes into a scrubber containing a thin sludge of $Fe(OH)_3$ and the iron sulphide liquor is drawn off at the bottom and run into a vessel called the oxidizer, where air is blown through it to oxidize it back to $Fe(OH)_3$. The liquor then goes back to the scrubber to be used again.

Referring to the accompanying drawing, the gas enters the washer at the bottom and passes out again at the top. The iron sulphide liquor is drawn from the washer by the centrifugal pump and passes, together with compressed air entering through a nozzle, into the oxidizer. (This process requires only 3 parts of air per 100 of gas, whereas the Koppers process requires 30). To give a long air path and maximum utilization of air, the oxidizer is made very tall in comparison to its diameter. The intimate mixture of air and liquid rises high in the oxidizer and is separated in the sulphur separator. The regenerated liquor goes back to the scrubber through the overflow line. The separator is equipped for removing the thick froth of sulphur which floats on the liquor and passing it, with the spent air, into the sulphur tank from which batches of sulphur are taken from time to time to be washed and dried in the centrifuge. Sulphuric acid is removed from the spent air by ammonia treatment in the acid washer, and the spent air then escapes. The sulphate liquor is worked up in the ammonia plant for solid ammonium sulphate.

The success of this process depends on the fundamental discovery that the sulphur, under properly controlled conditions, readily floats on the liquor in a concentrated form, thus making possible the continuous circulation of the same solution. About 85 per cent of the sulphur removed is recovered as crude sulphur, the rest being oxidized to sulphite, thiosulphate, etc. To prevent too great an accumulation of salts, the liquor from the centrifuge is run to the ammonia stills and replaced by fresh water, the loss in iron being made up by addition of ferric sulphate.

H_2S Removal Unit at G.f.K.

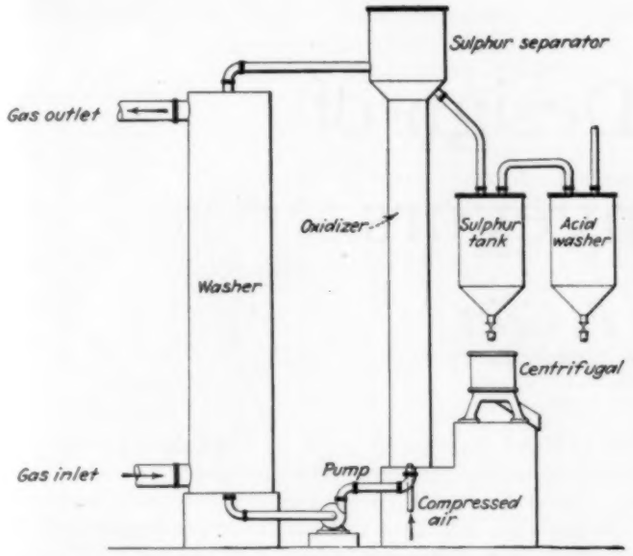
The process has given good results in the G.f.K.'s small scale and semi-technical experiments and in an installation of the Gewerkschaft Mont Cenis (capacity 120,000 cu.m. of gas per day), although all these setups were constructed with any available material and therefore did not meet all the best conditions of the process. The G.f.K. large-scale installation has been operating quite successfully for some months.

TESTS were also made with a cyanide scrubber which, according to the G.f.K., yields the cyanide as NH_4SCN. Large-scale operation was successful, and it was found that previous removal of cyanide is not strictly necessary for the sulphur recovery installation. Preliminary cyanide removal may, however, be desirable; at least, it pains a technologist's conscience to let the cyanide be wasted.

The scrubber efficiency at Mont Cenis was 99.5 per cent when operating at 5,000 cu.m. per hour, and rose to 99.9 per cent at 3,000 cu.m. per hour. Of course, thorough distribution of the scrubbing liquid over the cross-section of the tower is essential. No clogging with iron sludge has ever been observed.

The ammonia content of the gas, over a long period, averaged 4.7 g. per cu.m. before and 2.4 after the treatment. The difference was used up in the formation of thiosulphate and sulphate, already mentioned. When ferric hydroxide is used instead of the sulphate for iron replenishment, the amount of ammonia used decreases.

Costs of installing and operating, per cu.m. of gas,



Layout of the Apparatus for H_2S Removal used by the Gasellschaft für Kohlentechnik, m.b.H., Dortmund, Germany

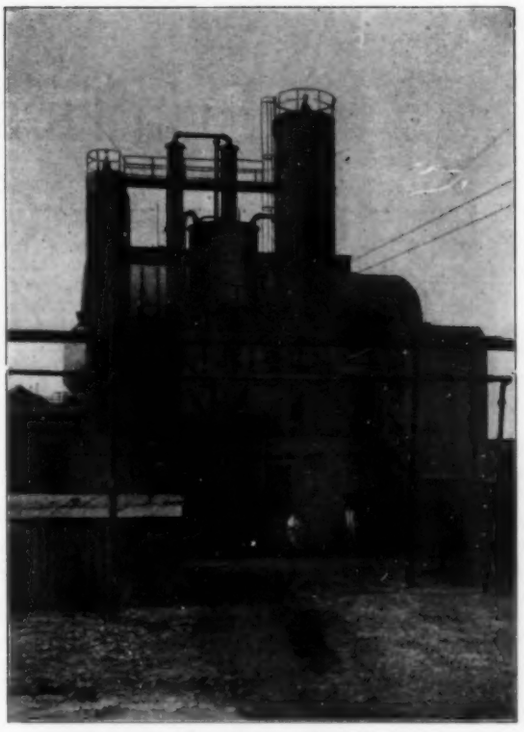
decrease rapidly with increasing size of plant. The following cost figures are taken from results gained in actual experience:

DAILY OPERATING COSTS OF A DESULPHURIZING PLANT FOR 10,600,000 CU.FT. PER TWENTY-FOUR HOURS, WITH 336 GRAINS OF SULPHUR PER 100 CU.FT. (WITHOUT CYANIDE SCRUBBER).

1. *Amortization and interest,* including general marks overhead (17% on the capital)	71.40
2. *Wages* (2 men per shift)	33.00
3. *Power for pumps* (24 kw. h. per hour at 3 pfg.)	17.75
4. *Compressed air:* 10,000 cu.m. at 0.35 pfg.	35.00
5. *Operating the centrifuge,* steam and water consumption	5.06
6. *Ammonia loss*	3.50
7. *Repairs, oil, packing*	10.00
8. *Iron Sulphate,* 1.1 t. at M45	49.60
Total	M225.31

Counting 6 grains of sulphur from 7 grains of H_2S (the loss representing thiosulphate), this gives each day 2.6 tons of crude sulphur containing 1.8 tons of sulphur, or 69 per cent. The rest consists of 10 per cent ferric hydroxide, 20 per cent water and small amounts of ammonia and tarry matter. The value of the sulphur at 4.6 pfg. per kg. is M83 per day, which reduces the costs to M142.31. This means a refining charge of 0.048 pfg. per cu.m., counting capital charges, or 0.024 pfg. without them. In American units this would be 0.16c. per 1,000 cu.ft., whereas Sperr allows 1c. It should be noted, however, that the conditions for the American and German processes are not strictly comparable and that the former higher cost should not necessarily be condemned.

Since the refining cost, even in the G.f.K. process, is a considerable item, the G.f.K. has devised a method of refining the sulphur so that it will bring a much higher price. Experimental large-scale operation of this method is under way. It obviates the necessity of buying iron sulphate for replacement, since the iron is recovered from the crude sulphur. Even the thiosulphate is recovered, and the pyrites and other cheap sulphur wastes from the coal-washing plant are worked up. It is expected that this process will bring enough return for refined sulphur to pay all the costs of gas purification and sulphur refining and leave sufficient surplus for writing off slowly the cost of the purifying plant.



Another View of the Purifying Unit

The Carl Still Co., Recklinghausen, Germany, has undertaken the construction of installations for gas purification and sulphur refining by the G.f.K. processes in Germany.

Underground Pipe Coating Materials

As a part of the report of a subcommittee on pipe coatings, rendered at the American Gas Association meeting in Chicago October, 1927, there was given the following statement of the characteristics of a good material for coating mains and service pipes to minimize corrosion damage:

(a) The coating material should be impervious to air and moisture.

(b) It should adhere tenaciously to the surface of the pipe.

(c) It should not be brittle at 0 degrees Centigrade (32 degrees Fahrenheit) or soften to such an extent at 60 degrees Centigrade (140 degrees Fahrenheit) that it will run or rub off during handling.

(d) It should withstand, without chipping or spalling off, the shocks and abrasion to which the pipe is likely to be subject during transportation and installation

(e) The coated pipe should not stick together during transportation.

(f) The material should be easily applied either in the yard or in the field.

(g) The material should be of such a character that any damage occurring in the field can be readily repaired after installation.

Practical Design of Belt Conveyors

By Harry F. Geist
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EDITOR'S NOTE: *The November issue of Chem. & Met. presented an article by Mr. Geist in which the theory of the principal calculations involved in conveyor design was fully discussed. Tables were also included which gave empirically determined characteristics of belts of various widths, as well as data for the comparison of inclined belts with those on horizontal centers. To permit the chemical engineer to facilitate the investigation of his conveyor problems, Mr. Geist has prepared for the current issue a number of tables derived by means of his formulas, which, when used with tables I to III previously published, will permit of a ready solution to every conveyor problem which may be encountered.*

THE TABLES given on the following pages show not only the ability of various sized shafts to move belts of different widths, and plies within reasonable practice, but they also give the required effective pull for steady motion and the power needed to produce a belt speed of 100 ft. per minute. Use of the effective pull enables the designer to properly proportion other parts of the conveyor, such as tail-shaft, snub-shafts and take-up. It is to be noted that centers are in all cases those for horizontal belts with plain grease type carriers.

Tables IV to XIII inclusive, it will be noted, are subdivided each into four sections to denote respectively the four distinct classes previously outlined.

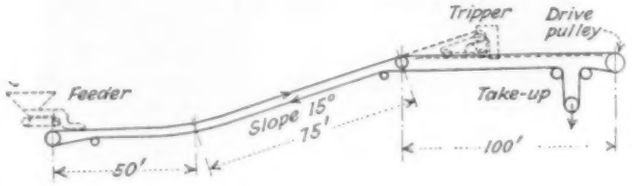

Fig. 8—Diagram of Belt Conveyor Used in Examples Herein

From the above tables it will be evident, as shown in the following examples, that a method is hereby established covering a wide range of belt conveyors whereby information can be selected for the design of belt conveyors without the use of laborious calculations.

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TABLE IV—1 7/16 INCH HEADSHAFT
Maximum Horizontal Belt Centers (Plain Bearings) In Feet

Class	Belt	18 Inches			24 Inches			30 In.
	Ply	6	5	4	6	5	5	5
	Pully M Inches	30/20 13.5	24/20	20/20	30/26 10.5	24/26	20/26	24/32 12
1	Material Lb. per Cu.Ft.							
	Average lb.	321	350	363	352	410	445	316
	0	259	307	352	225	289	348	172
	25	179	207	230	144	177	205	99
	50	141	157	171	105	128	145	69
	75	111	126	136	75	100	113	54
	100	93	105	113	69	82	92	43
	Horsepower	0.97	1.06	1.11	1.07	1.25	1.35	0.96
2	Material Lb. per Cu.Ft.							
	Average lb.	347	382	400	385	437	484	341
	0	280	335	388	247	308	378	185
	25	194	226	253	157	189	223	107
	50	148	171	188	115	137	158	75
	75	120	137	150	82	107	123	58
	100	101	115	124	75	88	100	47
	Horsepower	1.06	1.16	1.22	1.17	1.33	1.47	1.04
3	Material Lb. per Cu.Ft.							
	Average lb.	413	461	497	450	520	582	380
	0	334	405	483	288	366	455	206
	25	231	273	314	184	225	268	119
	50	177	207	234	135	163	190	83
	75	143	166	186	96	127	148	65
	100	120	139	154	88	105	120	52
	Horsepower	1.26	1.40	1.51	1.37	1.58	1.74	1.15
4	Material Lb. per Cu.Ft.							
	Average lb.	521	605	653	544	653	740	523
	0	421	531	634	348	460	578	284
	25	291	358	413	222	283	341	164
	50	223	271	308	163	205	242	128
	75	180	218	245	129	160	188	89
	100	152	183	203	107	131	153	71
	Horsepower	1.58	1.84	1.98	1.65	1.98	2.24	1.58

Horsepower at 100 ft. per minute in belt speed.
Belts taken as 28-oz. duck ¼-in. and 1/16 in. rubber covered.

TABLE V—2 1/16-INCH HEADSHAFT
Maximum Horizontal Belt Centers (Plain Bearings), In Feet

Class	Belt	18 Inches			24 Inches			30 Inches		
	Ply	6	5	4	6	5	4	7	6	5
	Pulley M Inches	30/20 14	24/20	20/20	30/26 10.75	24/26	20/26	36/32 12.25	30/3	24/32
1	Material Lb.per Cu.Ft.									
	Average Lb.	662	700	720	790	846	882	545	625	695
	0	534	615	699	507	596	690	252	312	378
	25	370	415	456	323	367	407	156	187	218
	50	283	314	340	237	266	288	113	134	153
	75	229	252	270	187	216	223	88	104	118
	100	193	211	224	155	170	183	72	85	95
	Horsepower	2.01	2.12	2.18	2.39	2.56	2.67	1.65	1.90	2.11
2	Material Lb.per Cu.Ft.									
	Average Lb.	725	765	790	853	915	960	585	672	730
	0	585	672	767	547	644	752	271	336	397
	25	405	453	500	348	396	442	167	202	229
	50	310	343	373	256	287	314	121	144	160
	75	251	275	296	202	225	243	95	112	124
	100	211	230	245	167	184	199	78	92	100
	Horsepower	2.20	2.31	2.39	2.59	2.77	2.91	1.78	2.04	2.21
3	Material Lb.per Cu.Ft.									
	Average Lb.	870	942	985	1000	1130	1180	704	795	920
	0	702	827	957	642	795	922	326	397	500
	25	486	558	623	408	489	543	201	239	289
	50	372	422	465	300	354	384	146	170	202
	75	301	339	369	237	276	298	114	132	157
	100	254	284	306	196	227	243	94	108	126
	Horsepower	2.64	2.87	2.98	3.03	3.42	3.57	2.13	2.41	2.79
4	Material Lb.per Cu.Ft									
	Average Lb..	1090	1230	1325	1210	1390	1550	805	978	1180
	0	879	1080	1285	776	980	1210	373	489	641
	25	608	727	838	493	601	715	230	294	370
	50	465	551	626	363	436	507	167	210	259
	75	378	442	497	286	340	392	130	163	201
	100	318	370	412	237	280	320	107	133	162
	Horsepower	3.31	3.73	4.02	3.66	4.21	4.70	2.44	2.97	3.57

Horsepower at 100 ft. per minute belt speed.
Belts 28-oz. duck ¼-in. and 1/16-in. rubber covered.

TABLE VI—2⅞-INCH HEADSHAFT

Maximum Horizontal Centers (Plain Bearings), In Feet

Class	Belt	18 Inches			24 Inches			30 Inches			36 Inches			42 Inches	
	Ply	6	5	4	6	5	4	7	6	5	8	7	6	7	6
	Pulley M Inches	30/20 15	24/20	20/20	30/26	24/26	20/20	36/32	30/32	24/32	40/38	36/38	30/38	36/44	30/44
1	Material Lb. per Cu.Ft.			Max.											
	Average Lb.	1100	1140	960	1315	1375	1280	1015	1100	1150	725	875	955	753	863
	0	*888*	*1000*	932	*842*	*970*	1058	*466*	*550*	*625*	*255*	334	*395*	*260*	*322*
	25	*615*	*675*	607	*537*	*595*	609	*288*	*330*	*360*	*156*	*197*	*225*	*145*	*173*
	50	*470*	*510*	453	*394*	*430*	418	*208*	*235*	*252*	*112*	*140*	*158*	*100*	*118*
	75	*380*	*410*	358	*311*	*336*	330	*163*	*183*	*196*	*88*	*109*	*122*	77	90
	100	*320*	*343*	298	*257*	*277*	265	*134*	*150*	*158*	*72*	*89*	*99*	*62*	*72*
	Horsepower	3.33	3.45	2.95	3.98	4.17	3.9	3.07	3.33	3.48	2.20	2.65	2.9	2.29	2.62
2	Material Lb. per Cu.Ft.														
	Average Lb.	1200	1250	1036	1410	1500	1378	1050	1190	1245	775	940	1050	835	950
	0	*968*	*1097*	1005	*903*	*1057*	1140	*486*	*595*	*676*	*273*	*359*	*433*	*288*	*354*
	25	*670*	*739*	655	*575*	*648*	656	*300*	*357*	*390*	*167*	*212*	*248*	*150*	*190*
	50	*512*	*560*	488	*423*	*470*	450	*217*	*256*	*273*	*120*	*151*	*174*	*111*	*130*
	75	*415*	*450*	386	*334*	*367*	355	*170*	*198*	*212*	*94*	*117*	*133*	*85*	*99*
	100	*350*	*376*	321	*276*	*302*	285	*140*	*162*	*171*	*77*	*95*	*109*	*69*	*80*
	Horsepower	3.64	3.79	3.15	4.27	4.55	4.17	3.18	3.61	3.78	2.35	2.85	3.18	2.53	2.88
3	Material Lb. per Cu.Ft.			Max.											
	Average Lb.	1450	1545	1237	1665	1820	1643	1300	1435	1525	1000	1115	1250	1000	1140
	0	*1170*	1355	1200	*1068*	*1280*	1360	*601*	*717*	*828*	*352*	*425*	*516*	*348*	*425*
	25	*810*	914	782	*680*	*787*	782	*371*	*431*	*478*	*215*	*251*	*295*	*192*	*228*
	50	*620*	692	583	*500*	*570*	537	*268*	*307*	*335*	*155*	*178*	*207*	*133*	*156*
	75	*502*	553	461	*394*	*445*	424	*210*	*239*	*260*	*121*	*138*	*159*	*102*	*119*
	100	*422*	465	383	*326*	*366*	341	*173*	*195*	*209*	*99*	*113*	*129*	*82*	*96*
	Horsepower	4.09	4.69	3.75	5.05	5.51	5.00	3.94	4.35	4.62	3.03	3.37	3.79	3.03	3.46
4	Material Lb. per Cu.Ft.														
	Average Lb.	1860	1965	1573	2060	2360	2090	1625	1825	2020	1350	1420	1650	1250	1520
	0	*1500*	1723	1527	*1320*	*1660*	1635	*752*	*912*	*100*	*476*	*542*	*682*	*421*	*567*
	25	*1040*	1162	996	*841*	*1040*	965	*465*	*548*	*633*	*290*	*320*	*389*	*240*	*304*
	50	*795*	882	742	*618*	*740*	683	*336*	*390*	*444*	*209*	*227*	*273*	*166*	*208*
	75	*643*	707	590	*488*	*578*	530	*263*	*304*	*345*	*163*	*176*	*210*	*127*	*158*
	100	*542*	592	488	*403*	*475*	423	*216*	*248*	*278*	*134*	*144*	*171*	*103*	*128*
	Horsepower	5.63	5.95	4.77	6.24	6.85	6.36	4.92	5.53	6.12	4.09	4.30	5.00	3.79	4.61

Hp. at 100 ft. per minute.
Note:—Centers given in black roman type represent maximum for belt.
Belts up to 30-in. inclusive 28-oz. duck. Belts over 30-in. 32-oz. duck. Rubber cover ¼-in. and 1/32-in.

These tables are intended for use on horizontal and up-grade conveyor problems only. For such belts as are intended to operate on descending slopes and which may generate instead of consume power, a separate investigation is recommended in each particular case, employing the reverse of the principles set forth in the previous theoretical discussion.

Let us assume that it is desired to move run of mine coal at the rate of 200 tons per hour by means of a belt conveyor such as shown by Fig. 8. Coal is taken as weighing 50 lb. per cu.ft. The belt carriers are to be considered as of the plain grease bearing type. For this example the feeder and the tripper shown in the figure will be neglected. Assume that breakage of coal is to be minimized, for which a belt speed of from 200 to 250 ft. per minute is considered good practice.

From Table I we see that a 36-in. belt moving at a speed of 100 ft. per minute will handle up to 103 tons per hour of material at 50 pounds per cubic foot containing a maximum lump of 14 in. not exceeding 20 per cent of the aggregate. A 36-in. belt will therefore do the work desired at a speed of 195 ft. per minute when fully loaded. (To take care of irregularities in loading the material onto the belt it is advisable to run the belt at a slightly higher speed, say 225 ft. per minute, but for the solution of this problem we will adhere to the 195 ft. per minute.) The belt ply required will be determined later.

The next step is to determine the equivalent horizontal centers for the system shown by Fig. 8 in order to prepare the problem for use of Tables IV and XIII inclusive. Since we are considering plain grease bearing type belt carriers let us turn to Table II. Opposite the 36-in. belt section for 50 lb. per cu.ft. material under 15 deg. slope we see that 100 ft. of horizontal belt conveyor is equal to 39.8 to 42.5 ft. at that slope depending upon whether the belt to be used is light or heavy. To be more conservative than precise we will accept the smaller value and call 40 ft. the equivalent of 100 ft. horizontal.

TABLE VII.—3⅞ INCH HEADSHAFT

Maximum Horizontal Centers in Feet (Plain Bearings)

Class	Belt	18 Inches		24 Inches		30 Inches			36 Inches			42 Inches			48 Inches	
	Ply	6	5	6	5	7	6	5	8	7	6	8	7	6	8	7
	Pulley M Inches	30/20 16	24/20	30/26 12½	24/26	36/32 14	30/32	24/32	40/38 15½	36/38	30/38	40/44 17	36/44	30/44	40/51 18¾	36/51
1	Material Lb. per Cu.Ft.	Max.	Max.	Max.	Max.											
	Average Lb.	1440	1200	1920	1600	1750	1865	1975	1500	1590	1600	1356	1437	1530	1150	1250
	0	1160	1052	1230	1128	*810*	*932*	*1073*	*528*	*607*	*702*	*433*	*495*	*570*	*336*	*395*
	25	804	710	784	692	*500*	*560*	*619*	*322*	*358*	*401*	*249*	*276*	*306*	*183*	*207*
	50	615	538	576	501	*362*	*399*	*433*	*232*	*255*	*282*	*175*	*191*	*210*	*126*	*141*
	75	498	430	453	391	*284*	*310*	*337*	*182*	*197*	*216*	*135*	*146*	*159*	*96*	*107*
	100	420	361	377	322	*233*	*254*	*272*	*149*	*161*	*176*	*110*	*118*	*128*	*78*	*86*
	Horsepower	4.37	3.64	5.85	4.85	5.3	5.65	5.98	4.55	4.82	5.15	4.11	4.36	4.63	3.48	3.78
2	Material Lb. per Cu.Ft.															
	Average Lb.	1550	1294	2070	1725	1900	2000	2140	1630	1740	1835	1480	1567	1670	1255	1380
	0	1250	1135	1330	1216	*880*	*1000*	*1164*	*574*	*664*	*758*	*472*	*540*	*623*	*367*	*436*
	25	865	766	845	747	*542*	*600*	*671*	*350*	*392*	*433*	*272*	*301*	*335*	*200*	*229*
	50	662	580	622	541	*393*	*428*	*470*	*253*	*279*	*304*	*191*	*208*	*229*	*137*	*155*
	75	536	564	489	422	*308*	*333*	*365*	*197*	*216*	*234*	*147*	*159*	*174*	*105*	*118*
	100	452	390	406	347	*253*	*273*	*294*	*162*	*176*	*190*	*120*	*129*	*140*	*85*	*95*
	Horsepower	4.7	3.95	6.28	5.23	5.76	6.06	6.48	4.93	5.28	5.56	4.48	4.74	5.06	3.80	4.18
3	Material Lb. per Cu.Ft.															
	Average Lb.	1850		2470	2060	2280	2440	2600	1925	2100	2250	1740	1915	2100	1550	1690
	0	1490		1583	1450	*1056*	*1220*	*1413*	*678*	*800*	*930*	*556*	*660*	*783*	*453*	*535*
	25	1033		1010	892	*652*	*753*	*815*	*414*	*473*	*532*	*320*	*368*	*421*	*247*	*280*
	50	790		742	646	*472*	*522*	*571*	*298*	*337*	*373*	*225*	*255*	*288*	*170*	*191*
	75	640		583	503	*370*	*406*	*443*	*232*	*261*	*286*	*173*	*195*	*219*	*130*	*144*
	100	540		485	415	*304*	*333*	*358*	*191*	*213*	*233*	*141*	*158*	*177*	*105*	*116*
	Horsepower	5.61		7.5	6.25	6.91	7.39	7.88	5.83	6.37	6.82	5.27	5.80	6.36	4.70	5.12
4	Material Lb. per Cu.Ft.															
	Average Lb.	2355		3150	2620	2860	3180	3500	2370	2650	2930	2170	2400	2750	1960	2200
	0	1900		2020	1845	*1825*	*1590*	*1903*	*735*	*1010*	*1210*	*694*	*827*	*1025*	*572*	*695*
	25	1315		1285	1135	*817*	*955*	*1095*	*510*	*598*	*692*	*400*	*461*	*552*	*312*	*365*
	50	1005		946	822	*592*	*680*	*769*	*370*	*425*	*486*	*280*	*320*	*377*	*215*	*248*
	75	815		747	642	*463*	*530*	*597*	*287*	*330*	*373*	*216*	*245*	*287*	*164*	*188*
	100	687		618	528	*381*	*433*	*482*	*236*	*269*	*304*	*176*	*198*	*231*	*132*	*151*
	Horsepower	7.13		9.55	7.95	8.67	9.64	10.6	7.18	8.03	8.88	6.58	7.27	8.33	5.94	6.67

See 2⅞ in. Shaft.

Hp. at 100 ft. per minute belt speed.
Note:—Centers in roman type are maximum for belt. Belts up to 30-in. inclusive .28 oz. duck, over 30-in. are 32 oz. Rubber cover ¼-in. and 1/32-in.

TABLE VIII.—3⅞ INCH HEADSHAFT

Maximum Horizontal Centers in Feet (Plain Bearings)

Class	Belt	30 Inches			36 Inches			42 Inches			48 Inches		54 Inches		60 Inches	
	Ply	7	6	5	8	7	6	8	7	6	8	7	9	8	9	8
	Pulley M Inches	36/32 14.5	30/32	24/32	40/38 16	36/38	30/38	40/44 17.5	36/44	30/44	40/51 19.25	36/51	44/57 20.75	40/57	44/63 22.25	40/63
1	Material Lb. per Cu.Ft.		Max.	Max.												
	Average Lb.	2655	2710	2260	2340	2430	2530	2120	2250	2350	1915	2030	1500	1625	1115	1420
	0	*1286*	1355	1230	*824*	*929*	*1045*	*675*	*775*	*876*	*560*	*642*	*370*	*438*	*253*	*350*
	25	*758*	807	710	*503*	*547*	*597*	*390*	*432*	*472*	*305*	*337*	*193*	*220*	*125*	*166*
	50	*549*	580	496	*362*	*390*	*419*	*274*	*300*	*322*	*210*	*229*	*131*	*147*	*83*	*109*
	75	*430*	448	383	*283*	*302*	*322*	*211*	*229*	*245*	*160*	*173*	*99*	*110*	*61*	*81*
	100	*354*	370	315	*233*	*246*	*262*	*172*	*186*	*198*	*129*	*139*	*80*	*88*	*49*	*64*
	Horsepower	8.06	8.25	6.85	7.1	7.37	7.67	6.43	6.82	7.13	5.80	6.15	4.65	4.92	3.38	4.30
2	Material Lb. per Cu.Ft.															
	Average Lb.	2860	2920	2430	2530	2635	2750	2300	2440	2560	2090	2210	1700	1800	1220	1555
	0	*1326*	1460	1320	*890*	*1000*	*1135*	*735*	*841*	*955*	*611*	*700*	*420*	*486*	*277*	*384*
	25	*817*	870	762	*544*	*593*	*649*	*423*	*469*	*513*	*334*	*367*	*219*	*244*	*137*	*181*
	50	*591*	625	534	*392*	*422*	*456*	*297*	*325*	*351*	*229*	*249*	*149*	*163*	*91*	*119*
	75	*463*	482	412	*306*	*327*	*350*	*229*	*249*	*267*	*175*	*189*	*112*	*122*	*68*	*88*
	100	*381*	398	339	*252*	*267*	*285*	*186*	*201*	*215*	*141*	*152*	*90*	*97*	*54*	*70*
	Horsepower	8.67	8.85	7.35	7.67	7.98	8.33	6.98	7.40	7.76	6.34	6.70	5.15	5.45	3.70	4.7
3	Material Lb. per Cu.Ft.															
	Average Lb.	3395	3480	2900	2985	3160	3380	2760	2960	3240	2540	2660	2000	2135	1480	1900
	0	*1570*	1740	1575	*1050*	*1205*	*1390*	*882*	*1020*	*1210*	*742*	*842*	*494*	*577*	*336*	*469*
	25	*971*	1040	910	*642*	*712*	*798*	*508*	*568*	*650*	*405*	*442*	*258*	*289*	*166*	*222*
	50	*702*	745	637	*462*	*507*	*560*	*357*	*394*	*444*	*279*	*300*	*175*	*193*	*110*	*145*
	75	*550*	575	492	*361*	*393*	*431*	*275*	*302*	*338*	*212*	*279*	*132*	*145*	*82*	*108*
	100	*452*	475	405	*297*	*321*	*350*	*224*	*245*	*273*	*171*	*183*	*106*	*115*	*66*	*86*
	Horsepower	10.6	10.55	8.8	9.05	9.58	10.25	8.37	8.98	9.83	7.70	8.07	6.06	6.47	4.48	5.76
4	Material Lb. per Cu.Ft.															
	Average Lb.	4110	4430	3700	3610	3880	4330	3420	3700	4100	3180	3460	2500	2800	1710	2500
	0	*1900*	2215	2010	*1270*	*1480*	*1790*	*1092*	*1275*	*1530*	*930*	*1095*	*617*	*756*	*388*	*617*
	25	*1175*	1330	1160	*776*	*874*	*1085*	*630*	*711*	*822*	*507*	*575*	*323*	*379*	*192*	*292*
	50	*850*	950	813	*560*	*622*	*718*	*442*	*493*	*562*	*349*	*391*	*219*	*254*	*127*	*192*
	75	*666*	738	632	*437*	*482*	*553*	*341*	*377*	*427*	*266*	*296*	*165*	*190*	*95*	*142*
	100	*548*	605	508	*359*	*394*	*450*	*277*	*306*	*345*	*215*	*238*	*133*	*152*	*76*	*113*
	Horsepower	12.46	13.45	11.25	10.95	11.75	13.15	10.36	11.20	12.43	9.63	10.5	7.58	8.5	5.20	7.6

Hp. at 100 ft. per minute belt speed. Centers in roman type are belt maximums.
Belts 30-in. are 28-oz. duck, over 30-in. are 32-oz. Rubber cover ¼-in. and $\frac{1}{16}$-in.

Therefore, 75 ft. at 15 deg. slope is equal to 75x 100/40 or 187 ft. horizontal. In addition we have from Fig. 8 a total of 150 ft. horizontal conveyor which added to the above 187 ft. gives a total equivalent horizontal length of 337 ft. Class 3 as indicated by Fig. 8 is recommended.

From Table VII, opposite the Class 3 section for 50 lb. per cu.ft. material, under the 36-in. belt columns we see that a $3\frac{7}{16}$ in. diameter head shaft will pull a 36-in., 6-ply 32-oz. rubber covered belt loaded as above for a haul of 373 ft. horizontal on plain grease type carriers. From Table VI we see that a $2\frac{15}{16}$ in. diameter head shaft is not sufficient for 337 ft. Table IX reveals that the 36-in., 6-ply belt is good for a maximum haul of 690 ft. based upon full normal working strength, so that we may accept the $3\frac{7}{16}$ in. diameter head shaft and the 6-ply belt as satisfactory for the work to be done.

The effective pull required for the haul of 337 ft. is obtained from Table VII by direct proportion and is equal to 337/373 × 2,250 lb., or 2,020 lb.

TABLE IX.—$4\frac{7}{16}$-INCH HEADSHAFT

Maximum Horizontal Centers in Feet (Plain Bearings)

Class	Belt	30 Inches	36 Inches			42 Inches			48 Inches		54 Inches		60 Inches	
	Ply	7	8	7	6	8	7	6	8	7	9	8	9	8
	Pulley M Inches	36/32 15	40/38 16½	36/38	30/38	40/44 18	36/44	30/44	40/51 19.75	36/51	44/57 21.25	40/57	44/63 22.75	40/63
1	Material Lb. per Cu.Ft.	Max.			Max.									
	Average Lb.	3160	3435	3500	3240	3160	3315	3470	2900	3050	2520	2680	2220	2460
	0	1465	*1210*	*1337*	1340	*1010*	*1142*	*1295*	*848*	*965*	*622*	*725*	*505*	*607*
	25	900	*738*	*790*	768	*581*	*637*	*696*	*462*	*507*	*326*	*363*	*249*	*287*
	50	655	*516*	*561*	536	*408*	*441*	*477*	*318*	*344*	*221*	*242*	*166*	*188*
	75	508	*416*	*435*	414	*315*	*338*	*362*	*242*	*261*	*167*	*182*	*124*	*140*
	100	421	*342*	*355*	336	*256*	*274*	*292*	*196*	*210*	*134*	*145*	*99*	*112*
	Horsepower	9.6	10.4	10.6	9.85	9.58	10.1	10.55	8.80	9.25	7.63	8.12	6.73	7.45
2	Material Lb. per Cu.Ft.													
	Average Lb.	3410	3700	3850	3500	3425	3615	3745	3175	3290	2765	2900	2440	2630
	0	1580	*1303*	*1470*	1446	*1093*	*1245*	*1400*	*928*	*1040*	*682*	*784*	*550*	*650*
	25	971	*795*	*869*	830	*630*	*695*	*752*	*507*	*547*	*357*	*393*	*274*	*307*
	50	706	*573*	*617*	580	*442*	*481*	*514*	*348*	*372*	*242*	*262*	*182*	*201*
	75	548	*448*	*478*	446	*342*	*368*	*390*	*265*	*281*	*183*	*196*	*136*	*150*
	100	455	*368*	*391*	363	*278*	*298*	*315*	*214*	*226*	*147*	*157*	*109*	*120*
	Horsepower	10.35	11.2	11.68	10.6	10.4	11.0	11.35	9.62	9.98	8.38	8.78	7.40	7.97
3	Material Lb. per Cu.Ft.													
	Average Lb.	4060	4375	4580	4170	4110	4315	4575	3680	4000	3280	3485	2925	3280
	0	1880	*1540*	*1750*	1720	*1312*	*1490*	*1740*	*1076*	*1265*	*809*	*941*	*664*	*809*
	25	1160	*941*	*1034*	987	*756*	*830*	*918*	*587*	*665*	*424*	*472*	*328*	*383*
	50	840	*678*	*735*	690	*531*	*576*	*628*	*403*	*452*	*288*	*316*	*218*	*251*
	75	653	*530*	*570*	532	*410*	*441*	*477*	*308*	*342*	*217*	*246*	*163*	*187*
	100	541	*436*	*466*	432	*334*	*357*	*385*	*249*	*275*	*175*	*189*	*130*	*149*
	Horsepower	12.3	13.25	13.9	12.65	12.45	13.1	13.87	11.15	12.15	9.93	10.58	8.86	9.94
4	Material Lb. per Cu.Ft.													
	Average Lb.	5170	5325	5790	5320	5085	5450	5950	4800	5125	4200	4500	3630	4275
	0	2390	*1875*	*2210*	2200	*1626*	*1880*	*2220*	*1405*	*1623*	*1035*	*1216*	*825*	*1055*
	25	1475	*1145*	*1305*	1255	*936*	*1050*	*1195*	*765*	*852*	*543*	*610*	*407*	*500*
	50	1068	*825*	*929*	882	*658*	*726*	*817*	*527*	*579*	*369*	*407*	*271*	*328*
	75	839	*646*	*720*	678	*508*	*556*	*621*	*402*	*438*	*279*	*305*	*203*	*245*
	100	690	*530*	*588*	552	*413*	*451*	*502*	*325*	*353*	*224*	*244*	*162*	*194*
	Horsepower	15.7	16.15	17.55	16.15	15.4	16.55	18.05	14.55	15.55	12.73	13.65	11.0	12.95

Hp. at 100 ft. per minute belt speed. Centers in roman type are belt maximums.
Belts 30-in. are 28-oz. duck, over are 32-oz. duk. Rubber cover ¼-in. and $\frac{1}{16}$-in.

The power required (net at the head shaft) is also obtained from Table VII by direct proportion for the centers and is equal to 337/373 × 6.82, or 5.96 hp. for each 100 ft. per minute of belt speed, or 5.96 × 195/100 equals 13.6 hp. for the job. A 15 hp. motor is consequently recommended for use with this installation.

From the above calculations we may tabulate the following synopsis:

Capacity .....200 tons per hour run of mine coal
Belt (rubber covered) 36 in., 6-ply, 32 oz.
Speed .....195 ft. per min. (225 ft. per min.)
Centers, Per Fig. 8.....225 ft.
Equivalent horiz. centers 337 ft.
Belt carriers .....Plain grease bearing type
Head shaft .....$3\frac{7}{16}$ in. diameter
Head pulley (5 x belt ply) 30x38 in. rubber covered
Effective pull 337/373 x 2,250 2,020 lb.
Initial tension (.4 for Class No. 3) 808 lb.
Max. belt tension .....2,828 lb.
Net power 13.6 hp. (15 hp. motor)
Bolt tension percentage of normal full working strength .....38.1 per cent

As a second example, let us assume the same problem as per the first example, except that the belt carriers are to be anti-friction (either ball or roller bearing type). The belt width and speed are taken same as for example No. 1.

Referring to Table III, opposite the 36-in. belt for 50 lb. per cu.ft. material, we see that 100 ft. horizontal centers on plain grease carriers is equal to 150 ft. horizontal on anti-friction type carriers and also equal to 45.8 to 49.6 ft. at 15 deg. up grade (use 46). Thus we find that the only changes are in equivalent centers, which are reduced from 337 ft. to 263 ft. with the consequent reduction in effective pull to 1,590 lb., in maximum belt tension to 2,226 lb. and in power to 9.36 hp. The economy is evidently in reduced power and in decreased wear and tear.

We may again assume the same problem, using anti-friction carriers and adding the tripper in Fig. 8. A safe estimate for the tripper is 2.5 hp. per 100 ft. per minute belt speed, or 4.95 hp. at 195 ft. per minute. This added to the power to move the belt, 9.36 hp., gives a total power requirement of 14.26 hp. or 7.3 hp. per 100 ft. per minute speed.

TABLE X—4 11/16-INCH HEADSHAFT

Maximum Horizontal Centers in Feet (Plain Bearings)

Class	Belt	36 Inches		42 Inches			48 Inches		54 Inches		60 Inches	
	Ply	8	7	8	7	6	8	7	9	8	9	8
	Pulley M Inches	40/38 17	36/38	40/44 18.5	36/44	30/44	40/51 20.25	36/51	44/57 21.75	40/57	44/63 23.25	40/63
1	Material Lb. per Cu.Ft.	Max.	Max.			Max.						
	Average Lb.	4340	3780	4125	4260	3780	3820	4000	3430	3575	3140	3350
	0	1530	1445	*1320*	*1470*	1410	*1117*	*1265*	*847*	*1080*	*713*	*827*
	25	935	855	*760*	*820*	760	*610*	*665*	*443*	*483*	*353*	*392*
	50	673	606	*534*	*568*	520	*419*	*452*	*301*	*323*	*234*	*257*
	75	523	470	*412*	*435*	394	*320*	*342*	*228*	*242*	*175*	*191*
	100	432	380	*335*	*352*	318	*258*	*275*	*183*	*193*	*140*	*152*
	Horsepower	13.2	11.50	12.5	12.9	11.45	11.6	12.15	10.4	10.85	9.51	10.15
2	Material Lb. per Cu.Ft.											
	Average Lb.	4675	4075	4500	4670	4075	4175	4340	3700	3900	3470	3600
	0	1650	1560	*1440*	*1610*	1520	*1220*	*1375*	*913*	*1055*	*788*	*890*
	25	1010	922	*827*	*898*	819	*666*	*722*	*478*	*528*	*390*	*421*
	50	725	654	*582*	*622*	560	*458*	*490*	*325*	*353*	*259*	*276*
	75	566	507	*449*	*476*	425	*350*	*371*	*245*	*265*	*194*	*205*
	100	466	413	*365*	*386*	344	*282*	*298*	*197*	*211*	*155*	*164*
	Horsepower	14.2	12.35	13.65	14.15	12.35	12.66	13.16	11.2	11.83	10.5	10.9
3	Material Lb. per Cu.Ft.											
	Average Lb.	5570	4860	5400	5620	4860	5050	5270	4570	4750	4230	4475
	0	1960	1855	*1725*	*1940*	1815	*1477*	*1670*	*1130*	*1285*	*963*	*1105*
	25	1200	1100	*991*	*1087*	975	*807*	*876*	*592*	*643*	*476*	*523*
	50	764	780	*698*	*750*	667	*554*	*595*	*402*	*430*	*316*	*343*
	75	675	605	*539*	*573*	506	*422*	*451*	*304*	*323*	*236*	*255*
	100	555	494	*438*	*464*	410	*341*	*362*	*244*	*258*	*189*	*203*
	Horsepower	17.2	14.75	16.36	17.0	14.75	15.3	16.0	13.85	14.4	12.85	13.6
4	Material Lb. per Cu.Ft.					Max.						
	Average Lb.	7100	6180	6875	7220	6180	6500	6850	5830	6150	5330	5700
	0	2500	2360	*2190*	2490	2300	*1900*	*2170*	*1440*	*1665*	*1212*	*1410*
	25	1525	1395	*1265*	1486	1240	*1040*	*1140*	*755*	*833*	*600*	*667*
	50	1100	993	*889*	962	850	*713*	*774*	*512*	*557*	*398*	*437*
	75	860	770	*687*	736	645	*544*	*586*	*387*	*417*	*298*	*325*
	100	706	628	*558*	596	520	*440*	*472*	*311*	*334*	*238*	*259*
	Horsepower	21.5	18.75	20.85	21.9	18.75	19.7	20.75	17.7	18.65	16.2	17.3

Horsepower at 100 ft. per minute belt speed. Centers in roman type are belt maximums.
Belts are 32-oz. duck with $\frac{1}{4}$ in. and $\frac{1}{16}$ in. rubber cover.

TABLE XI—5 1/16 INCH HEADSHAFT

Maximum Horizontal Centers in Feet (Plain Bearings)

Class	Belt	42 inches		48 inches			54 inches			60 inches		
	Ply	9	8	9	8	7	10	9	8	10	9	8
	Pulley M inches	44/44 19	40/44	44/51 20.75	40/51	36/51	48/57 22.25	44/57	40/57	48/63 23.75	44/63	40/63
1	Material Lb. per Cu.Ft.		Max.			Max.						
	Average Lb.	5550	5050	5140	5265	5050	4625	4800	4900	4285	4460	4650
	0	*1630*	1615	*1390*	*1540*	1600	*1090*	*1185*	*1325*	*927*	*1012*	*1147*
	25	*975*	930	*785*	*840*	840	*585*	*620*	*664*	*470*	*501*	*543*
	50	*694*	652	*546*	*578*	570	*399*	*422*	*444*	*315*	*333*	*357*
	75	*540*	498	*420*	*441*	431	*303*	*319*	*332*	*237*	*249*	*265*
	100	*441*	410	*341*	*356*	347	*244*	*256*	*266*	*189*	*208*	*211*
	Horsepower	16.85	15.35	15.6	16.0	15.3	14.0	14.55	14.85	13.0	13.55	14.1
2	Material Lb. per Cu.Ft.											
	Average Lb.	6000	5440	5590	5730	5440	5050	5200	5350	4675	4925	5050
	0	*1765*	1740	*1510*	*1680*	1720	*1190*	*1284*	*1445*	*1010*	*1120*	*1245*
	25	*1052*	1000	*854*	*915*	905	*638*	*672*	*725*	*512*	*553*	*591*
	50	*750*	703	*595*	*630*	615	*436*	*456*	*485*	*344*	*368*	*387*
	75	*583*	543	*457*	*480*	465	*331*	*345*	*363*	*258*	*275*	*288*
	100	*476*	442	*370*	*388*	374	*266*	*277*	*290*	*207*	*220*	*230*
	Horsepower	18.2	16.5	16.95	17.4	16.5	15.3	15.75	16.2	14.2	14.95	15.3
3	Material Lb. per Cu.Ft.											
	Average Lb.	7190	6490	6765	7015	6500	6020	6375	6615	5740	6025	6250
	0	*2150*	2075	*1830*	*2050*	2060	*1420*	*1573*	*1785*	*1240*	*1370*	*1542*
	25	*1260*	1195	*1034*	*1120*	1080	*760*	*824*	*896*	*630*	*677*	*731*
	50	*899*	839	*719*	*771*	735	*519*	*560*	*600*	*422*	*450*	*480*
	75	*699*	647	*553*	*588*	555	*394*	*423*	*449*	*317*	*337*	*356*
	100	*571*	527	*448*	*475*	447	*318*	*340*	*359*	*254*	*269*	*284*
	Horsepower	21.8	19.7	20.5	21.3	19.7	18.25	19.3	20.1	17.4	18.3	18.95
4	Material Lb. per Cu.Ft.											
	Average Lb.	8985	8260	8545	8985	8260	7700	8100	8550	7250	7660	8220
	0	*2640*	2635	*2310*	*2630*	2610	*1818*	*2000*	*2310*	*1570*	*1740*	*2025*
	25	*1575*	1518	*1304*	*1418*	1372	*973*	*1047*	*1160*	*795*	*860*	*961*
	50	*1122*	1066	*908*	*987*	933	*664*	*711*	*775*	*533*	*565*	*630*
	75	*874*	823	*698*	*752*	706	*504*	*538*	*580*	*401*	*428*	*469*
	100	*714*	670	*566*	*607*	567	*406*	*432*	*464*	*321*	*342*	*374*
	Horsepower	27.25	25.1	25.9	27.25	25.1	23.35	24.65	25.9	22.0	23.25	25.0

Horsepower at 100 ft. per minute belt speed. Centers in roman type are belt maximums.
Belts are 32-oz. duck $\frac{1}{4}$ in. and $\frac{1}{16}$ in. rubber cover.

From Table VII we see that 7.3 hp. per 100 ft. per minute for a 36-in. belt fully loaded with 50 lb. per cu.ft. material is in excess of recommendations listed for a $3\frac{7}{16}$ in. diameter shaft. We therefore turn to Table VIII from which by proportioning according to horsepower using the ratio 7.3/10.25 we arrive at the following presentation of the summary of results:

Capacity .....200 tons per hour run of mine coal
Belt (rubber covered) 36 in., 6-ply, 32 oz.
Speed .....195 ft. per min. (225 ft. per min.)
Centers .....225 ft. (with extra machinery)
Equivalent centers 7.3/10.25x560, 398 ft. horizontal plain carriers
Belt carriers....Anti-friction type
Head shaft.....$3\frac{11}{16}$ in. diameter
Head pulley .....30x38 in. rubber covered
Effective pull 7.3/10.25 x 3380 2,410 lb.
Initial tension (.40)..... 964 lb.
Belt tension .....3,374 lb.
Net power at 195 ft. per min. 14.25 hp. (20 hp. motor)
Belt tension percentage of normal full working strength 57.7 per cent (7.3/12.65)

The results above listed when compared with example No. 2 show how the addition of the feeder and tripper to the belt load increase the size of the head shaft required, the effective pull, belt tension and horsepower.

The above three examples demonstrate the more common and apparent uses for the tables presented. These tables are thought to be particularly useful because they show almost at a glance, the manner in which values change with width and ply of belting.

Résumé: For determining belt capacity and speed use Table I. For translating sloping belt conveyor centers using plain grease bearing type carriers into an equivalent horizontal centers with plain grease carriers (for reference to Tables IV to XIII, inclusive) use Table II. For translating sloping belt conveyors having anti-friction type carriers into their equivalent horizontal centers with plain grease type carriers (for reference to Tables IV to XIII, inclusive) use Table III. For translating horizontal belt conveyors having anti-friction carriers into equivalent horizontal centers with plain grease carriers (for reference to Tables IV to XIII, inclusive) see Table III; (divide by 1.5). For specific data on belt conveyors, either true horizontal centers on plain grease type carriers or equivalent horizontal centers as obtained by the use of either Table II or III, use Tables IV to XIII, inclusive, for information on power, ply, shaft size and the maximum permissible haul.

Note—Values listed in the Tables V to XIII, inclusive, are based upon the combined bending and torsional moments for the various head shafts and allow in each case for the weight of the pulleys. The dimensions indicated in these tables which affect the bending and torque govern, but may be changed with corresponding changes in the results listed. Horsepower is, throughout the tables, calculated upon the basis of an ideal belt speed of 100 ft. per minute, and may be corrected to actual by ordinary proportion.

TABLE XIII—6¼ INCH HEADSHAFT

Maximum Horizotal Centers in Feet (Plain Bearings)

Class	Belt	48 inches		54 inches				60 inches				
	Ply	10	9	11	10	9	8	12	11	10	9	8
	Pulley M inches	48/51 21.75	44/51	54/57 23.25	48/57	44/57	40/57	60/63 24.75	54/63	48/63	44/63	40/63
1	Material	Max.	Max.			Max.	Max.					
	Lb. per Cu.Ft.											
	Average Lb.	7190	6470	7040	7500	7275	6475	6450	6800	7000	7140	7280
	0	1800	1750	*1765*	*1770*	1795	1750	*1836*	*1875*	*1515*	*1625*	*1800*
	25	1050	988	*860*	*948*	941	876	*663*	*720*	*768*	*802*	*852*
	50	742	688	*594*	*647*	639	587	*455*	*488*	*515*	*533*	*558*
	75	573	528	*453*	*491*	483	440	*345*	*369*	*387*	*399*	*416*
	100	467	428	*367*	*396*	388	351	*278*	*297*	*310*	*319*	*331*
	Horsepower	21.8	19.6	21.35	22.75	22.1	19.7	19.55	20.8	21.25	21.65	22.1
2	Material											
	Lb. per Cu.Ft.											
	Average Lb.	7750	6980	7830	8160	7850	6970	6900	7380	7600	7700	7760
	0	1940	1885	*1740*	*1930*	1940	1885	*1322*	*1492*	*1645*	*1753*	*1918*
	25	1131	1067	*957*	*1032*	1015	941	*710*	*781*	*833*	*865*	*908*
	50	800	742	*661*	*705*	690	632	*486*	*530*	*560*	*575*	*595*
	75	618	570	*504*	*535*	521	473	*369*	*400*	*420*	*430*	*443*
	100	503	463	*408*	*432*	419	378	*298*	*323*	*336*	*344*	*353*
	Horsepower	23.5	21.2	23.75	24.75	23.8	21.2	20.9	22.4	23.05	23.35	23.55
3	Material											Max.
	Lb. per Cu.Ft.											
	Average Lb.	9250	8320	9420	9920	9350	8320	8380	9000	9400	9700	9250
	0	2310	2250	*2095*	*2340*	2310	2250	*1607*	*1820*	*2130*	*2205*	2285
	25	1350	1270	*1152*	*1255*	1210	1128	*862*	*952*	*1030*	*1090*	1080
	50	955	855	*795*	*857*	821	754	*590*	*646*	*692*	*725*	710
	75	738	680	*607*	*650*	620	565	*448*	*488*	*520*	*542*	528
	100	601	552	*491*	*524*	500	452	*362*	*393*	*416*	*433*	420
	Horsepower	28.1	25.25	28.6	30.1	28.4	25.3	25.4	27.3	28.5	29.4	28.1
4	Material											
	Lb. per Cu.Ft.											
	Average Lb.	11770	10600	11920	12800	11900	10600	10520	11400	12325	12800	11800
	0	2940	2865	*2650*	*3020*	2940	2870	*2070*	*2300*	*2665*	*2910*	2915
	25	1718	1620	*1456*	*1616*	1538	1438	*1080*	*1205*	*1350*	*1437*	1380
	50	1213	1128	*1007*	*1105*	1045	960	*740*	*817*	*907*	*955*	905
	75	938	866	*767*	*838*	790	719	*562*	*618*	*681*	*715*	672
	100	765	703	*621*	*675*	635	575	*453*	*497*	*546*	*572*	537
	Horsepower	35.6	32.1	36.1	38.8	39.1	32.1	31.9	34.6	37.4	38.8	35.75

Hp. at 100 ft. per minute belt speed. Centers in roman type are belt maximums.
Belts are 32-os. duck, ¼-in. and $\frac{1}{16}$-in. rubber cover.

TABLE XII—5½ INCH HEADSHAFT

Maximum Horizontal Centers in Feet (Plain Bearings)

Class	Belt	48 inches		54 inches				60 inches				
	Ply	10	9	11	10	9	8	12	11	10	9	8
	Pulley M inches	48/51 21.25	44/51	54/57 22.75	48/57	44/57	40/57	60/63 24.25	54/63	48/63	44/63	40/63
1	Material											
	Lb. per Cu.Ft.											
	Average Lb	6100	6270	5430	5750	5875	5950	4700	5080	5400	5465	5650
	0	*1525*	*1695*	*1207*	*1360*	*1450*	*1610*	*900*	*1027*	*1170*	*1240*	*1395*
	25	*890*	*956*	*664*	*727*	*758*	*806*	*484*	*538*	*592*	*614*	*660*
	50	*629*	*667*	*458*	*496*	*516*	*539*	*331*	*354*	*397*	*408*	*433*
	75	*487*	*512*	*350*	*377*	*390*	*403*	*252*	*276*	*298*	*305*	*322*
	100	*396*	*416*	*283*	*303*	*314*	*323*	*213*	*222*	*239*	*244*	*257*
	Horsepower	18.5	19.0	16.4	17.45	17.8	18.05	14.25	15.4	16.4	16.6	17.15
2	Material											
	Lb. per Cu.Ft.											
	Average Lb.	6650	6820	5875	6250	6380	6535	5080	5480	5800	6000	6150
	0	*1662*	*1845*	*1305*	*1477*	*1577*	*1765*	*974*	*1110*	*1255*	*1365*	*1520*
	25	*970*	*1040*	*718*	*790*	*825*	*885*	*523*	*508*	*636*	*674*	*719*
	50	*686*	*726*	*496*	*539*	*560*	*592*	*358*	*393*	*427*	*448*	*472*
	75	*530*	*558*	*378*	*410*	*424*	*443*	*272*	*297*	*320*	*335*	*351*
	100	*432*	*452*	*306*	*330*	*340*	*354*	*219*	*239*	*257*	*268*	*280*
	Horsepower	20.2	20.7	17.8	18.95	19.35	19.8	15.4	16.65	17.6	18.2	18.65
3	Material		Max.									
	Lb. per Cu.Ft.											
	Average Lb.	8125	8320	7000	7580	7840	8100	6100	6680	7150	7440	7600
	0	*2030*	2250	*1555*	*1790*	*1936*	*2190*	*1170*	*1350*	*1550*	*1690*	*1876*
	25	*1186*	1270	*855*	*960*	*1013*	*1095*	*628*	*707*	*785*	*836*	*889*
	50	*838*	855	*590*	*654*	*688*	*734*	*430*	*479*	*526*	*556*	*583*
	75	*648*	680	*451*	*497*	*521*	*550*	*326*	*362*	*395*	*416*	*433*
	100	*528*	552	*365*	*400*	*418*	*439*	*263*	*292*	*316*	*332*	*346*
	Horsepower	24.7	25.25	21.2	23.0	23.8	24.55	18.5	20.3	21.7	22.6	23.1
4	Material											
	Lb. per Cu.Ft.											
	Average Lb.	10400	10600	9080	9860	10275	10730	7700	8580	9350	9800	10200
	0	*2600*	2865	*2015*	*2330*	*2535*	*2900*	*1475*	*1735*	*2020*	*2230*	*2520*
	25	*1516*	1620	*1112*	*1247*	*1327*	*1458*	*793*	*908*	*1025*	*1103*	*1190*
	50	*1070*	1128	*766*	*851*	*901*	*971*	*542*	*615*	*689*	*732*	*781*
	75	*828*	866	*585*	*646*	*681*	*727*	*412*	*466*	*516*	*548*	*581*
	100	*675*	703	*473*	*520*	*548*	*582*	*332*	*375*	*414*	*438*	*463*
	Horsepower	31.5	32.1	27.55	29.9	31.15	32.5	23.4	26.0	28.4	29.7	30.9

Horsepower at 100 ft. per minute belt speed. Centers in roman type are belt maximums.
Belts are 32-os. duck ¼ in. and $\frac{1}{16}$ in. rubber cover.

Erratum: In Mr. Geist's previous article in the November, 1927 issue, equations (1) and (1a) were incorrectly printed as being in ft. lb. instead of lb.

Possibilities of a Lumbang Oil Industry

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LUMBANG oil is extracted from the kernels of the fruit of the *Aleurites Moluccana,* which is widely distributed throughout the islands of the Pacific, West Indies, Florida and Brazil. The sources that we are most interested in are the Philippine and Hawaiian Islands, some of the West Indies and southern United States.

Various estimates give the oil production per tree as 10 lb. to 60 lb. per year. On a plantation where the trees are given plenty of room, the average production would probably be at least 40 lb. As the kernel is one-third of the weight of the nut and contains about 50 per cent oil, this would mean a production of 240 lb. nuts per tree per year.

Trees have been known to bloom as young as three years old, but it is better to consider six years as the age at which they begin to produce. The nuts are very difficult to sprout due to the hard shell, so it is necessary in every case to crack the shell to insure the most rapid germination.

In the Philippine Islands, the fruit is allowed to fall to the ground and remain until the hulls decay. This does not affect the oil content or its properties to any extent, and the nuts can be stored for about two years without serious deterioration. The extraction of the oil is done by crude methods, either locally or by the Chinese around Manila. The nuts are heated and then suddenly cooled which either cracks the shells or causes the kernels to draw away from them. In the latter case, the nuts are cracked by hand and the kernels picked out and pressed. Either process is laborious. The kernels are stored until enough have accumulated for extraction. It is here that the deterioration takes place, the acid number increasing rapidly the longer they are stored. The writer has heard of samples running over 90 mg. of KOH per gram and has analyzed samples running as high as 40 mg. West and Brown mention a case where the acidity of the oil increased from 0.55 to 5.32 when the kernels were stored in a cold, dry place for one month. In a hot, moist place, the change would have been greater. Consequently, the oil should be extracted immediately after the nuts are cracked.

A PAINT firm in Manila had so much trouble obtaining a raw oil that could be refined without undue shrinkage, that it decided to buy the nuts and extract the oil in its own factory. The nuts will be ground in an oil mill and the pulp containing the kernels and shells hot-pressed. After settling, this should give a raw oil as good as linseed and one that, although it might be darker, should pass the color specifications for linseed oil. It is estimated that the oil can be produced there cheaper than linseed oil can be purchased. It will also be cheaper and more satisfactory than the former practice where every lot of oil had to be refined before use. Although Aguilar states that this procedure will produce 45 lb. less oil per ton of nuts, it seems to be the only means of quantity production, especially where labor is high.

West and Smith found lumbang and linseed oils of equal value for paints, varnishes, straw hat polishes, putties, soaps, printing and stamping inks and rubber substitutes. They tried out the raw, boiled and blown oils. The following table gives the analysis of the oils used by them:

Constants	*Linseed*	*Lumbang*
Index of refraction (Abbe 30° C)	1.4770	1.4724
Saponification value	190.6	197.2
Iodine value (Hübl)	163.7	145.5
Acid value (per cent)	6.91	15.29
Viscosity (Saybolt 37.8° C)	144.0	138.0
Surface tension (dynes)	35.5	36.9

There is one thing to remember, though, in a consideration of the possibilities of a lumbang oil industry. The oil cake cannot be used as a stock feed due to its strong purgative properties. Nor can it be used as a fertilizer unless the kernels are separated from the shells before they have been pressed as the following analyses of Aguilar will show:

Constituents	*Cake from Kernels*	*Cake from Crushed Nuts*
Moisture	11.13%	8.46%
Nitrogen (N_2)	8.86%	1.25%
Potash (K_2O)	1.67%	0.68%
Phosphorus ($_2O_5$)	1.02%	0.25%

THE following specifications drawn up by the writer (in collaboration with Frederick L. Smith, 2nd, chemist, U. S. Q. M. Laboratory, Manila, P. I.) would cover a satisfactory grade of lumbang oil for use in place of linseed oil in paint manufacture. In fact, an oil of this grade is being used in making paints in the Philippine Islands.

Raw lumbang oil.—The oil shall be absolutely pure, well settled, free from foots and remain perfectly clear at 20 deg. C. It shall be sweet, fresh, free from rancidity and shall conform strictly and in every way to the following requirements:

Constants	*Maximum*	*Minimum*
Loss on heating at 105-110° C (per cent)	0.5	——
Foots by volume (per cent)	2.0	——
Acid Number (mg. of KOH per gram)	10.0	——
Specific Gravity 15.5/15.5 C	0.930	0.920
Saponification Number	205.0	185.0
Unsaponifiable Matter (per cent)	1.5	——
Iodine Number (Hanus)	165.0	140.0
Unsaturated Glycerides (per cent)	——	97.0

Color—Not darker than a freshly prepared solution of 1.0g. of potassium bichromate in 100 c.c. pure sulfuric acid (1.84).

Smith, in a private communication recommends the introduction of the "Bromide Value" and the melting point of the hexabromides as a means of detecting the addition of fish oil. The writer believes, however, that the above tests would be unnecessary except on lumbang oil that might be imported into the States as such.

There seems to be no reason why the lumbang tree could not be grown in Florida, on deserted sugar plantations in Louisiana and southern California with profit to the paint manufacturers of the United States and to the United States as a whole. Also, plantations could be developed in the Philippine and Hawiian Islands, Cuba and the Virgin Islands.

The writer wishes to acknowledge his indebtedness to Dr. A. P. West, Forest Products Research Chemist, Bureau of Forestry, and F. L. Smith, 2nd, Chief Chemist, Quartermaster Corps., U. S. Army, both of Manila, P. I., for their helpful suggestions and criticisms during the preparation of this paper.

Production Exceeds Consumption of Chemicals in MIDDLE ATLANTIC States

THE AREA commonly referred to as the Middle Atlantic Seaboard extends from Central Virginia north to the Metropolitan New York area and includes parts of the states of Virginia, Pennsylvania, New York and Connecticut and all of Maryland, Delaware and New Jersey. It presents extremely diversified chemical industries that account for approximately 60 per cent of the chemical production of the entire country. Production exceeds the annual consumption of chemicals by at least $200,000,000, although the district must draw on the entire country for its supplies of basic raw materials, such as petroleum, bituminous coal, sulphur, and salt. Because of this great concentration in the face of a recognized tendency toward decentralization, the Middle Atlantic section probably offers fewer opportunities for the future development of new chemical industries.

From a marketing viewpoint the district may readily be divided into three areas tributary to Baltimore, Philadelphia and Metropolitan New York. It is on this basis that the Middle Atlantic Seaboard is discussed in the following brief surveys.

Baltimore Industries Serve Southern Markets

By A. E. Marshall
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FROM the manufacturing standpoint, the Baltimore district lacks many of the natural mineral resources which have brought other industrial areas to the fore. With the exceptions of coal, limestone and clay, Maryland has no other important mineral resources and, so, is dependent on other states and foreign countries for many of the raw materials it uses in fabricating its finished products. A glance at the map will indicate one of the reasons why Maryland continues as an important manufacturing state despite its lack of minerals, as the state while small has an extensive water boundary and its principal city, Baltimore, is located at the head of the Chesapeake Bay with a channel open throughout the year capable of passing ocean going vessels at practically all stages of the tide.

The manufacturing industries of Maryland are to a very large extent a result of its tidewater location and because of the facility with which imports can be handled, Maryland today is an important center for pig iron and steel production, the refining of petroleum, the smelting of copper, the refining of sugar and the manufacture of sulphuric acid and fertilizer.

The total manufactured products of the state of Maryland for 1925 had a value of $926,252,000, and Baltimore was responsible for more than 70 per cent of the value of the output. The 1923 Census gave figures of $903,446,222 for the entire state and $654,766,001 for the products manufactured in Baltimore.

The chemical manufacturing situation just about parallels the situation with regard to other manufactured products, as 85 per cent of all chemical products made in the state are produced within a radius of ten miles from Baltimore.

Fertilizer is an important item in Maryland's contribution to the chemical manufactures of the United States, as the state produced one-ninth of the total produced in the entire country. The 1923 figures are: United States, $183,089,000, and Maryland, $21,562,572, of which Baltimore contributed $18,440,000. Maryland has 45 fertilizer plants, a large number of them being dry mixers purchasing acid phosphate and other fertilizer ingredients from other factories and mixing these ingredients according to some definite formula.

The 1923 Census gives Maryland a rating of the second state in the Union as far as fertilizer products and number of wage earners employed in the industry.

Maryland's position in fertilizer manufacture is due to several factors. The principal seat of the fertilizer industry, Baltimore, is, as has been stated, located on tidewater and therefore manufacturers are able to bring in the necessary phosphate rock from Florida by steamer, the pyrites or sulphur from Europe or Texas by steamer, and Baltimore is one of the warehousing centers for the distribution of European potash in this country.

Other factors which have helped Maryland to its present position are the extensive truck-farming operations in the state itself, together with its location as the

most northerly of the so-called southern states. The fifteen southern states which are the natural market for Maryland products, such as fertilizer, produce one-half of the total truck-crops of the country.

A further view of the extensive agricultural interests of Maryland is the extent of its canning and preserving of fruits and vegetables. Maryland is surpassed only by California in the value of its canned fruit and vegetable products, and it has within its boundaries 406 factories employing 7,645 people and producing canned goods having a value of $28,422,000.

Of its raw materials limestone is widely distributed throughout the Piedmont and Appalachian regions of Maryland, the most important occurrences being in Baltimore, Carroll, Frederick, Washington and Alleghany counties.

The lime sold by Maryland producers during 1926 was 65,000 tons, valued at $497,000. The total United States production of lime in 1926 was 4,580,000 tons, having value of $40,800,000.

Coal mining in Maryland has shown a decline in the last twenty-five years, but the estimated coal reserves still give Maryland a fairly high rank as far as the future is concerned, in that the area is estimated at 519 square miles, and the total coal reserves at 8,000,000,000 tons. The actual coal mined in 1926 was 2,697,000 tons, whereas, in 1900 it was 4,024,688 tons.

The trend of industry in Maryland is the erection of factories producing materials for a southern market, and we find Maryland becoming an important center for enameling and stamping, druggists' preparations (Maryland is the sixth state in this particular field), slaughtering and packing of meat, manufacture of straw hats, glass (particularly bottles), clothing, umbrellas, paints and jewelry.

A study of the foregoing information will indicate that Maryland has succeeded in holding an important position in the manufacturing arts despite its small area, its small population (1,580,000) and its lack of natural resources.

Maryland has a stable population and has always been remarkably free from labor difficulties, so that its industrial future seems assured and there should be a continued growth of its chemical manufactures, particularly products which are the result of the use of raw materials which can be conveyed cheaper by water than by rail.

Chemical Manufacture in Philadelphia Area

By H. P. Bassett

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PHILADELPHIA is the chief center for the production and distribution of chemicals in the concentrated industrial area officially defined as the Third Federal Reserve District. This includes the eastern two-thirds of Pennsylvania, all of Delaware and the southern half of New Jersey. The 24,000 industrial plants of this district produce 10 per cent of the Nation's manufactures, having a total output valued at more than five billion dollars. The chemical and allied industries contribute a substantial proportion of this production.

Chemical manufacture, according to a regional survey made by the U. S. Department of Commerce, is more important in the Philadelphia district than in any of the states with the exception of New York, New Jersey and Pennsylvania. The chemical and allied industries employ more than 18,000 workers and produce approximately $166,000,000 worth of products each year. This is far in excess of the local consumption, with the result that much of the output is shipped outside of the area.

The Delaware River, between Wilmington and Philadelphia, is the location of most of the large chemical plants of the district. Dyes and other organic chemicals, coal-tar crudes and intermediates, explosives, heavy chemicals, and paint and varnish are produced on a larger scale here than elsewhere in the United States.

Of the chemical engineering group, the most important single industry is the refining of petroleum. As a refining center Philadelphia has only in recent years taken second place to Metropolitan New York. Part of the crude oil is received through pipe lines direct from the producing fields and much of it brought in by tankers from California, Gulf Coast, Mexico and South America. While the Philadelphia district itself is a good market for refined products, its location is such that export shipments may be easily made not only to foreign countries but also to the great eastern industrial centers. Eight large refineries in the district, employ about 6,000 workers and produce products valued at $113,470,000.

From the standpoint of chemical consumption, Philadelphia's most important industry is textile manufacturing. There are no less than 1,150 establishments engaged in this industry and the annual output is about a half billion dollars worth of product. The importance of dyestuffs and chemicals arises from the fact that the textile mills or connected establishments carry on scouring, carbonizing, bleaching, mercerizing, dyeing and finishing operations. The Census lists 130 dyeing and finishing plants in the district that annually purchase $15,700,000 worth of materials and produce a product valued at $34,500,000.

Leather tanning is also a leading industry in the Philadelphia district, since 28 per cent of the country's total output is produced there. The annual value of output is in excess of $263,000,000 with purchases of raw materials amounting to $182,000,000. Tanning is the most important single industry in Delaware, with a production of about $50,000,000. Large tanneries are located along the Delaware from Bristol to Wilmington. Philadelphia and Camden together are responsible for 45 per cent of the total production.

Trenton, which lies in the Philadelphia district, is an important center for the manufacture of tires and rubber goods, clay working, pottery and ceramic products. There are 15 rubber plants producing about $30,000,000 worth of products and purchasing nearly $18,000,000 worth of raw materials. Rubber hose is made on a large scale in Wilmington. The Trenton pottery industry produces nearly $12,000,000 worth of products which are shipped to all parts of the United States. There are 19 portland cement plants in the district, having an output valued at $50,000,000.

The paper and pulp industry is also of considerable importance although it is able to supply but about half of the requirements of the district. Plants within the Philadelphia city limits produce about 40 per cent of the $25,000,000 total output of the district. Wilmington is the center for a sizeable vulcanized fiber industry that is a large consumer of certain chemicals.

Metropolitan New York Still Chemical Capital

By S. D. Kirkpatrick
Associate Editor, Chem. & Met.

RECENTLY the Merchants Association of New York City, working with a number of industrial and statistical organizations, defined a new Metropolitan District for New York to include all territory within forty miles of City Hall, New York City. This composite area consisting of parts of New York, New Jersey and Connecticut embraces 3,768 square miles and has a population of 9,472,500 people. In it are more than 30,000 factories with an annual output worth $6,500,000,000. It is estimated that within this district are produced between 15 and 20 per cent of the total value of all chemicals and allied products manufactured in the United States. It is apparent, therefore, that Metropolitan New York is still the Nation's largest chemical center.

In 1924 the Committee on Plan of New York and Its Environs commissioned Dr. Mabel Newcomer to prepare an economic survey of the chemical industry of Metropolitan New York in relation to its present trends and probable future developments. The Newcomer report, published by the Committee as Economic Series Monograph No. 1, formed the basis of an article in *Chem. & Met.* (Vol. 30, No. 11, pages 422-5, March 17, 1924) to which the reader is referred for detailed economic and statistical information on the chemical industries of Metropolitan New York.

A most interesting trend observed at that time and since becoming even more emphasized is the tendency for the larger plants to migrate from the highly concentrated and densely populated centers toward the outlying sections of the area. Thus since 1917 there has been an actual decline in chemical manufacturing on Manhattan Island while certain branches of chemical engineering industry, such as soap making, petroleum refining, paint and varnish manufacture, and fertilizer production have disappeared entirely or are rapidly leaving Manhattan. This purely local migration is remarked here because the same economic forces at work in the Metropolitan area are forcing a national decentralization of chemical industry.

Records were obtained from 32 large chemical plants in Metropolitan New York which have moved during the past 25 years. Seventeen of these were originally on Manhattan, of which number eight moved to other sites on the Island, eight moved to New Jersey and one to Brooklyn. Of eight plants that were originally in Brooklyn, five moved to New Jersey, one to Richmond and two went out of the area to Buffalo and Baltimore, respectively. Six were New Jersey plants, five of which had moved from other sites in the same state while one moved to Pennsylvania. One plant came to New Jersey from the outside. The trend is evident: nine plants moved out of Manhattan while none moved in; eight moved out of Brooklyn and only one moved in; whereas fourteen have moved into New Jersey.

Analysis of the different branches of the chemical industry in Metropolitan New York reveals the extent to which concentration has taken place within the area.

The heavy chemical industry in New York has grown less rapidly than in the country as a whole. Measured in terms of both workers and output, the area still contains about one-fourth of the heavy chemical industry of the United States. This concentration has been due primarily to the advantages offered by the harbor for cheap transportation of raw materials and distribution of finished products to the industrial markets consuming heavy chemicals.

The fine chemical industries, exclusive of toilet preparations but including drugs, pharmaceuticals and medicinals, is a typical metropolitan industry. In 1922 there were 328 plants in this industry, employing more than 8,000 persons and producing about 10 per cent of the country's output.

METROPOLITAN New York is the largest petroleum refining center in the world and there is a trend toward further expansion. The twelve important refineries handle about 300,000 bbl. of crude oil per day, which is approximately 12 per cent of the total refining capacity of the United States. Measured in terms of value of product, the New York refining industry represents about 20 per cent of the total for the industry of the entire country.

Although the paint and varnish industry carries on little or no manufacturing in New York City, there is substantial production in Brooklyn and in Newark. Nearly one-half of the varnish output of the United States is produced in the Metropolitan New York area and about one-fourth of the paint output. A related industry, linseed oil, is represented in the district by four plants, one of which is the largest linseed plant in the world. The market for linseed oil offered by the paint and varnish and oilcloth and linoleum industries of the district is a most important one.

The dye industry has shown some progress in outlying sections of the district, notably in Brooklyn and on the New Jersey meadows, but is not well represented in a manufacturing way in New York proper. The soap industry is another that is gradually moving from Manhattan, the number of wage earners there decreasing from 948 in 1904 to 347 in 1919. Larger plants have been established in Brooklyn, on Staten Island, and in New Jersey. Increasing freight rates have stimulated some of the companies to establish branch factories to supply soap formerly shipped from New York. Thus one large Jersey City manufacturer has opened a large factory in Louisville, Kentucky, to supply a territory formerly served from New Jersey. Although most of the chemical engineering industries have shown gains in spite of the general migration, the fertilizer industry appears to be at a standstill in Metropolitan New York. The reasons for this are that the markets are principally in the South and West, the raw materials are heavy and mostly do not originate in New York, and finally, the finished products have practically the same bulk as the raw materials.

There are many other branches of chemical industry in Metropolitan New York that might very well be discussed were space available. These examples, largely taken from the Newcomer report and the new Industrial Directory of New Jersey, are sufficient to show, however, there has been a trend away from New York in case of all of the chemical industries that are unable to profit by the distinctive advantages offered by the New York harbor and the concentration of many chemical consuming industries. On the other hand, those industries that can capitalize to the fullest extent on these advantages have shown remarkable and consistent growth in Metropolitan New York.

Chemical Industries of VIRGINIA

Occupy a Leading Position in the South

By Wilbur A. Nelson

State Geologist, State Geological Survey, Charlottesville, Va.

WHEN one of the largest chemical companies in the world selects Virginia as the state in which to make an investment that will eventually exceed a hundred million dollars the industrial world, the bankers, and the country as a whole naturally must take notice. Within the past six months the Allied Chemical and Dye Corporation has selected a point on Chesapeake Bay, Hopewell, Virginia, and will there build a great nitrate plant. Contracts have been let for the first unit costing ten million dollars. Governor Harry Flood Byrd of Virginia after a meeting with the heads of this corporation in New York reports the following reasons for the selection of Virginia for this plant—abundance of labor, attractive climatic conditions, proximity to mines, abundant power, ample transportation by land and water, nearness to eastern markets, and finally of as much importance as the preceding reasons, the hospitable attitude of Virginia in inviting industry and the certainty of favorable taxation, both present and future. This is assured by the definite state policy against bond issues, thus safeguarding those who locate in Virginia against the tendency of this period toward the pyramiding of bond issues and the increasing taxation which naturally ensues.

Virginia has been called the Mother of Industry on the American continent. Here were located the first glass factory, the first salt works, the first iron works and iron furnaces, the first baking powder plant, and the first place where leather was manufactured on this continent. Thus there was a variety of chemical industries in Virginia even in the beginning of our history, approximately 300 years ago.

STATISTICS furnished by John Hopkins Hall, Jr., of the Virginia State Bureau of Labor and Industry show the total of the output of Virginia's chemical industry in 1926 was valued at $38,512,490. This total includes soda ash, caustic soda, bicarbonate of soda, metal foil, baking powder, fireworks, ink, yeast, oxygen, acetylene gas, ferrochrome, pottery, and liquid sulphur dioxide. And last, and of great importance, the rayon industry the products of which have a value of $25,264,312 for the year 1926.

In the January, 1927, issue of *Chemical & Metallurgical Engineering* tables are given showing the estimated chemical production and consumption in the United States, and Virginia's high rank is shown in these statistics in that it produced for the year 1923 over twenty-six million dollars worth of chemicals, while all of the industries within the state purchased approximately only eight and a half million dollars worth of similar products, showing a trade balance of chemicals shipped out of the state amounting to practically eighteen million dollars. This is by far the greatest total of any Southern state and is only exceeded by five other states: New York, New Jersey, Michigan, Ohio, and Illinois, in the order named. Every one of these states has a population of more than double that of Virginia. This brief summary shows clearly the most excellent conditions that exist in Virginia to make it a great future center of the chemical industry of the United States.

IN a leading position among Virginia's chemical industries are many large independent concerns. Probably one of the greatest of these is the Mathieson Alkali Works, with its plant at Saltville in the Valley of Southwestern Virginia, a valley having an elevation of 1,750 feet above sea level. Here occur the largest salt and gypsum deposits south of the Ohio River and east of the Mississippi, and from these natural salt brines this company produces primarily caustic soda, soda ash, and bicarbonate of soda. This plant is logically situated in relation to its raw material and the distribution to consumer markets inasmuch as the basic raw products necessary for its production consist primarily of salt and limestone which are immediately adjacent to the plant and under the control of the company. The principal additional raw material necessary to production, which is shipped in to the plant from outside, is coal, and this company is situated advantageously from a mileage standpoint as regards large production coal mines in nearby counties in Virginia.

The extensive improvements and developments of the Appalachian Power Company make power increasingly available at attractive rates, and the nearness to the es-

tablished coal fields makes the Saltville area an attractive manufacturing district. The products of the Mathieson Alkali Works are used by industries consuming chemicals and such industries in the Virginia district are pulp, paper, and textile mills, the artificial silk mills, glass works, the soap industry, oil industry, including cottonseed oil, and the iron and steel industry.

In the Saltville district are also located two large gypsum companies operating on gypsum deposits which are closely associated with the salt deposits of the Mathieson Alkali Works. These plants, the Southern Gypsum Company and the United States Gypsum Company, make all types of gypsum products. Since these are the only gypsum mines east of the Mississippi and south of the Ohio River, they enjoy an excellent trade which, will doubtless increase as the industrial development of the South goes forward.

Sulphuric acid, the barometer, as it has often been stated, of civilization, is likewise manufactured in Virginia. The plant of the General Chemical Company is located at Pulaski where acid is made from sulphide ores mined in an adjacent Virginia county near the town of Galax. In this part of Virginia occurs an ore belt known as the Great Gossan Lead, extending through several counties. This is a territory in which occurs a prominent vein of pyrite and pyrrhotite. It has been worked at a number of places and has produced in the past a great tonnage of ore and will undoubtedly produce much more in the future.

Another great source of sulphuric acid in Virginia is the pyrite district in Louisa and Spotsylvania counties which centers around the town of Mineral. Here occur extensive deposits of pyrite ore which have been worked to a depth of 1,500 feet. These mines, however, were shut down a few years ago when the price of sulphur from the Gulf Coast dropped to such a low point, but with the rise in the price of sulphur it is considered possible that these mines will shortly again be opened. There are undoubtedly large reserves of pyrite ore in this district.

IN THE TEXTILE industry Virginia has taken first rank as a maker of artificial silk. One of the largest plants of this type is located at Roanoke where the Viscose Corporation operate at the present time. The duPonts have purchased property near Richmond, Virginia, but the development of this property into an artificial silk plant has not yet been decided upon. If such a plant is located there, it will probably be one of the largest of its kind in the country. At Hopewell, Virginia, there is already located an artificial silk plant belonging to the Tubize Artificial Silk Company. The conditions in Tidewater Virginia along the tidal portions of the tributaries of Chesapeake Bay, as well as in southwestern Virginia, seem to be ideal for the location of such textile industries. Here can be found large quantities of water of the proper quality and quantity and other conditions which go to make a successful manufacturing center.

The greatest chemical development taking place in Virginia at the present time is that of the Allied Chemical and Dye Corporation, which company has started the installation of the first unit of a great plant for the fixation of nitrogen. This company has for the past five years had in operation an experimental plant involving a research investment of approximately $4,500,000, devoted to the manufacture and intensive study of nitrogen fixation. This work to date justifies the initiation of new installation, of large capacity, with a view to producing from raw material available in the United States synthetic nitrogen products in quantities sufficiently large to enable the United States to be independent eventually of importation of these products either as units of fertilizer or as munitions for the national defense. The economics as to plant location and the technical processes available at Muscle Shoals did not prove of interest and the company, therefore, has acquired a large acreage, accessible to both rail and deep-water carriers, at Hopewell, Virginia, for the location of the first installation.

In the lime industry Virginia occupies an important place. The total value of the annual output of this product is close to three million dollars. A number of modern plants are located in the Valley of Virginia and produce lime for chemical and other industries. Very high grade deposits of limestone occur at many points and they have been utilized by these companies in producing a product of the highest purity and quality.

MINERALS play an important part in Virginia's chemical industry. The state has a great diversity of such mineral resources. At the present time thirty-two minerals are being mined commercially, and those minerals which are so important in the chemical industry, such as coal, lime, limestone, salt, and pyrite occur in extensive deposits. Virginia has a practical monopoly on a material used almost exclusively in the making of acid-proof vats, sinks and laboratory furniture used extensively by the chemical industry. This material is known as Alberene stone. It is a ferro magnesium silicate which is quarried in Albemarle and Nelson counties of the Piedmont section of Virginia. Large mills and quarries are in operation and prepare this stone for the use of a constantly growing market. To the paint trade Virginia should be of interest on account of its red iron ores, its manganese, its ocher, and its rutile area, for in Nelson County occurs the largest rutile mine in the United States.

The coal deposits of Virginia are well developed and the total tonnage for 1926, according to the Virginia Bureau of Labor and Industry was 13,949,224 tons, with a value of $27,098,734.

One of the greatest assets of industry located in Virginia is the Port of Hampton Roads, as through this great harbor products can be shipped to all parts of the world and raw materials which do not occur in this section can likewise be received. The cities of Norfolk, Portsmouth, Hampton, Newport News, and Suffolk cluster around this great harbor. It is one of the greatest coal ports on this continent with annual shipments running as high as twenty-one million tons. It is likewise of first rank as a tobacco port, handling annually for foreign shipment leaf tobacco approximating in value $130,000,000.

Finally, the economic fact most likely to attract chemical industry to Virginia is the increasing growth of the South as the manufacturing and commercial section of the country, as shown by the number of new textile and other industrial operations that have located in the South during the past five years. The availability of raw materials within the State such as silica, sand, shale, limestone, coal, salt, pyrite, and gypsum makes this an especially desirable area on which to center chemical industry. It is an area at the gateway to the South. It is likewise in close proximity to the markets of the North and East and, through the Port of Hampton Roads, to the great industrial markets of the world.

Natural Resources of WEST VIRGINIA *Invite Many Chemical Operations*

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WEST VIRGINIA lies south of the Mason and Dixon line except for four counties in the Western Panhandle which are bounded on the east by Pennsylvania and on the west by the Ohio River. The Allegheny Mountains divide the state from Virginia on the east and the scuth eastern part, except for the three counties in the Eastern Panhandle which are in the Shenandoah Valley and are bounded on the north by the Potomac River and on the east by the Shenandoah River. The Big Sandy River divides the State from Kentucky on the south and southwest. The State contains 54 counties with an approximate area of 24,600 square miles.

An economic geological survey of the state of West Virginia shows that she holds a large reserve of raw material essential and well adapted for making chemical products. West Virginia rivers and railroads are so located as to provide ample transportation facilities of raw and finished products to all markets. The climate is characterized by moderate variations in temperature, both from season to season and from day to day. The mean annual temperature is less than 60 deg. F., ranging from 34 deg. in February to 76 deg. in July.

The Great Appalachian Coal Basin extends in a southwest direction between the Allegheny Mountains and the Ohio River, from Pennsylvania through Virginia, Kentucky, Tennessee into Alabama. The shape of this basin is like a crude canoe, with one end resting in Pennsylvania and the other in Alabama, while the broadest part of this basin rests in West Virginia. In this basin are found some of the best coals in the world. The coals are particularly well adapted for the use of the chemical industry, and the manufacture of all coal products, e.g. ammonia liquor, benzol and tar are the usual byproducts from this operation. The manufacture of fertilizers, medicines, explosives, dyes, perfumes, illuminating gas and many of the finished products essential to modern life begins with these raw materials.

The state has 160,000,000,000 tons of coal stored beneath the surface in its mountains. West Virginia was second in the United States in the mining and production of bituminous coal for a number of years until the year 1926, when her output of 140,000,000 tons considerably exceeded that of her nearest rival, Pennsylvania.

Oil and gas are other raw materials productive in West Virginla. Oil was first developed as early as 1805 in the Kanawha Valley near Charleston, in boring for salt water. Not much was done until nearly sixty years afterwards when oil was developed at Burning Springs in Wirt County. The State reached the peak of her production in 1901, when 14,177,126 bbl. was produced. Geologists estimate it will produce oil for more than 60 years.

For many years West Virginia produced and marketed commercially much more natural gas than any other state in the union. The peak of her gas production was reached in 1917 when the state produced 308,617,100,000 cu.ft. Since that time the production has been gradually declining. Geologists estimate that the State will produce gas for at least 50 years more. Borings made outside of known producing area indicate that the state will have a much larger territory for natural gas than was once supposed.

Gasoline is largely recovered from natural gas. This unblended product had a value in 1922 of nearly $10,000,000. From the plants in West Virginia it is transported to refineries for proper blending before marketing to the user. The gas also serves as raw material from which are manufactured a number of chemicals for different uses such as the olefine derivatives and amyl alcohol. Several plants are located in Kanawha County and extensive experiments are being made for obtaining other chemical products from natural gas.

West Virginia is well located for manufacturing purposes on account of its raw materials and cheap, excellent transportation facilities. A large plant has been recently installed at South Charleston for the manufacture of ethylene, acetone, solvents for rubber, dye, varnish products, and new products like ethylene glycol, glycol-diacetate, and ethylene dichloride. Among the hydrocarbon gases produced are commercial propane and ethylene.

Manufacture of salt was one of the earliest chemical industries in West Virginia. The southern part of the State is underlaid with a large basin of salt brine in

different strata, ranging in depth from 70 ft. to 2,200 ft. Wells are bored, the brine is pumped into vats and evaporated in several of the salt plants still in operation in the State. The byproducts recovered from the salt and used by chemical manufacturers include bromine, iodine and calcium and magnesium chlorides. The salt, when carefully made, analyzes 98 to 99 per cent NaCl, the remaining portion being made up of the chlorides of magnesium and calcium. It is of excellent grade and well adapted for chemical purposes in manufacturing caustic soda and chlorine. The largest chlorine production in the world is carried on at a new plant in South Charleston and chlorine is also used in producing carbon tetrachloride and amyl alcohol.

West Virginia has a large area of limestone on its eastern boundary. The great Greenbrier limestone strata extends in a southwest and northeast direction parallel to the Allegheny Mountains from Maryland to Virginia, running through Webster, Randolph, Greenbrier, Summers, Monroe and Nicholas Counties. Also a deposit of the Shenandoah limestone outcrops in Berkley and Jefferson Counties. Thus the state is rich in this valuable raw material for the manufacture of steel, lime, cement and chemical products. The physical character of this limestone varies in color from nearly white to a dark blue, and from hard crystalline rock to a soft stone. This limestone is mined and marketed in several places in the eastern part of the state.

The chemical composition of the limestone shows the following analysis, published by the State Geological Survey:

Calcium Carbonate	84 per cent to 92 per cent
Magnesium Carbonate	2 per cent to 4 per cent
Silica	2 per cent to 4 per cent
Alum	1 per cent to 2 per cent
Iron Oxide	Less than 1 per cent

Several plants are mining and manufacturing the limestone for construction purposes such as highway building and railroad ballast, and for chemical purposes, such as manufacture of lime, cement and calcium carbide.

West Virginia has a large stand of timber within its borders and a considerable quantity of wood is being manufactured into pulp. The Table I, published by the United States Bureau of Mines for the year 1923, shows the value of minerals and mineral products manufactured in the state:

Table I—Mineral Production in West Virginia in 1923.

Bromine	140,060 Lb.	$20,863
Calcium Chloride	10,607 Net tons	62,376
Clay products	.....	17,574,096
Clay (raw)	76,315 Net tons	158,294
Coal	107,899,941 Net tons	285,481,000
Coke	1,762,775 Net tons	11,103,716
Grindstone, pulp, etc	241,601 long tons	2,029,061
Mineral water (sold)	478,520 Gal.	79,447
Natural gas	203,867,000 M cu.ft.	69,981,000
Gasoline	63,358,000 Gal.	8,890,000
Petroleum	6,358,000 Bbl.	20,822,000
Salt	31,589 Net tons	284,196
Sand and gravel	2,437,600 Net tons	3,200,648
Sandstone	2,550,710 Net tons	2,660,415
Miscellaneous	.....	2,304,249
Total		$412,866,535

The clay industry of the state has a promising future. When the important deposits become fully prospected and are carefully considered in connection with the excellent transportation facilities, both by water and rail, and the proximity to markets, the clay industry should increase and develop into one of the best sources of wealth in the state. The clays are developed in the Eastern Panhandle, Western Panhandle and in the south and central parts and are manufactured into different commercial products.

West Virginia is one of the most important glass manufacturing centers in the United States on account of the abundant and cheap gas fuel and the large supplies of high-grade glass sand and pure limestone. Nearly all of the raw materials required for the manufacture of glass are found within the state. Glass sand is mined in Berkley county from the Silurian series and in Fayette county from the Middle Pottsville series.

CHEMICAL plants were first located in West Virginia more than twenty-five years ago and during the years 1915 to 1920 a large number of plants have been built within the state, especially, during the War period. There has been a marked increase even within the past year, thus giving encouraging evidence that West Virginia is destined to be a most important center of chemical industry.

This trend has been the result of a number of factors, the most important of which are the abundance of raw materials, excellent transportation facilities and attractive labor conditions. The working population of West Virginia has already proved itself adaptable to manufacturing iron and steel, chemical products, glass and kindred ceramic materials. The industries have at command many social, educational and religious advantages. Climate is equable and tends to stimulate labor to its greatest efficiency. Open shop conditions prevail in industries of the state, and in the local building trades. Several central power stations have high-tension electric lines traversing the entire area and furnishing available electric power at a cost that would be difficult to duplicate in any other state. Thus from all angles West Virginia is well equipped for manufacturing chemicals and the many other manufactured products in which chemicals are used.

Mechanics of Fertilizer Preparation

APPARENTLY the response of the growing plant to fertilizer is determined by composition and by manner and uniformity of distribution. This generalization is offered by W. H. Ross, A. R. Merz, and their co-workers in the Bureau of Soils as a result of their investigation of the mechanical behavior of fertilizer constituents and fertilizer mixtures. The mechanical condition and drillability under given conditions of temperature and humidity are, therefore, of great practical importance. Feed of a fertilizer through the drill varies with its apparent specific gravity and with the size of the particles. A material of uniform grains of about 20 mesh "can be distributed much more uniformly than the same product in the form of a fine powder or of a mixture of particles varying widely in size." Granulating processes for proper preparation of the fertilizer materials in uniformly sized particles were described in a paper recently presented before the A.C.S. Fertilizer Division.

Increasing percentages of nitrogen compounds and other soluble constituents in fertilizers increases the importance of controlling hygroscopicity. Measurements in practice indicate that the hygroscopic characteristic varies with the vapor pressure of the saturated solution of the substance, but that a mixture may have greater, intermediate, or less hygroscopic character than the properties of the original constituent materials would imply. Field and laboratory experiments both indicate that proper mechanical form is more important in controlling this property than is the chemical composition.

Opportunities in MISSISSIPPI *Emphasized by Flood Disaster*

By Craddock Goins
Mississippi State Board of Development, Jackson, Miss.

INFLUENCE of the recent flood disaster upon the development of chemical possibilities in the states of the Southern Mississippi Valley is a factor apparently overlooked in the considerable discussion that has gone abroad concerning the unhappy plight of the people of this area. In the light of a most remarkable rehabilitation program now in its final stages, it is possible to make a dispassionate survey of the situation in the lower valley and to observe that the next five years promise to see the people of this territory making more progress with their opportunities in this direction than ever before.

In this connection attention to the minerals possibilities of Mississippi has recently been drawn by L. J. Folse, general manager of the Mississippi State Board of Development. He points out that the northeastern portion of the state is rich in many valuable non-metallic minerals. Extending across the state from Meridian to Vicksburg is an important deposit of high-grade limestone. Following the Alabama line in Tishomingo and Itawamba counties, in the extreme northeastern section, is an area of paleozoic formation which carries a variety of clays, shales, limestone, building stone, glass sand and asphalt rock. West of this vicinity from the Tennessee line southward, is an important area of cretaceous formation rich in brick, pottery and tile clays, iron ore, limestone and paint pigments. Building and moulding sand, tile clays, bauxite, iron ore, bentonite and novaculite form other deposits awaiting development in another belt still farther west.

From a mineral standpoint, Dr. Henry Mace Payne, consulting engineer for the American Mining Congress, classes as possibly the richest single horizon in the state, the area extending from central Benton county westward into DeSoto county and southeastward to Kemper and Lauderdale counties, where it passes into Alabama. This embraces the great lignite belt of Mississippi in which, at Louisville, Winston county, there is a limited area of sub-bitumious coal of superior grade. This coal, officially tested, proves to be superior to any lignite and is about midway in heating value between lignite and good bituminous coal, burning to a fine, white, powdery ash, devoid of clinker.

A high silica refractory known as baukite has been developed and shown to exist on a commercial scale. This mineral has been known to metallurgy for only about five years. It originally was mined in the Austrian Tyrol, deriving its name from the small town where it was mined. A limited deposit of the material, varying less than one per cent in analysis, was found located in eastern Tennessee. Dr. Payne predicts that it will become the greatest refractory known for high temperature work.

Mississippi's happy position for mineral development is strengthened by a rail transportation system hardly equaled by any other state, with magnificent opportunities for distribution. Other factors are favorable climate, availability of good, cheap labor, with laws favorable to industry and commerce. What is being done toward developing consumption of these materials? What has the flood to do with this situation? Just this: The flood disaster has brought to the Mississippi Valley the inquiring eyes of men of industry of all sections of America. It is through the coming about of adequate rehabilitation and industrial development that men of vision can see a great transformation destined for this section—a transformation that calls for gigantic paper mills, furniture factories, paint and chemical factories.

An indication of what is promised for this section is this: During the first six months of 1927 Mississippi received more applications for charters for doing business in the state from so-called foreign capital than for the entire year of 1926, and 1926, incidentally, was one of the greatest years in the history of the state. Laws favorable to industry, coming about largely through the initiative of L. O. Crosby and L. J. Folse, in a huge development program, served to attract capital from all sections. At the end of the year foreign capital seeking to do business in the state amounted to $219,000,000 —about fifteen or twenty times greater than that for the combined preceding five years! Yet in the first six months of 1927, in the period of the great flood disaster, this state received bids from foreign capital aggregating $275,000,000!

As this industrial growth continues, one may be sure that the market for chemicals, for mineral deposits, for converting these raw materials into articles on commerce, will grow at a rate unprecedented in the section's history.

Identification System for Process Piping

EDITOR'S NOTE: *With the support of the National Safety Council and the American Society of Mechanical Engineers, a complete systematic plan for piping identification has been issued by the American Engineering Standards Committee. Abstracts from the plan are given herewith.*

For quite a long time pipe lines in various industrial plants have been painted in different colors for the purpose of ready identification. Because the selection of colors has been arbitrary and influenced by local conditions, and because a comprehensive extension of such schemes soon involves a mass of detail which automatically renders them impracticable, the inadvisability of recommending any of them for adoption as a universal Scheme is fairly obvious.

It is equally obvious that to attempt to outline a code in identification, would result in a system that would automatically be rendered impossible in those industries which do not have a major group of colors allocated to its products. It is found, however, that any materials transported in pipes in a plant fall in one of the following classifications:

Safe Products. These products are those involving no hazard in their handling and no extraordinary high value. A workman will run no undue risks in breaking into a pipe bearing a safe material.

Dangerous Materials. These materials are those which are in themselves hazardous to life or property.

Protective Materials. Under this class fall materials which are piped through plants for the express purpose of being available to prevent or minimize the hazard of the dangerous materials above mentioned. These include, for example, ammonia for combating phosgene fumes.

Extra Valuable Materials. These might be classified with the safe materials, but where these products have a very high value, it is preferable to give them a separate major classification.

Fire-Protection Equipment. This classification includes sprinkler systems and other fire-fighting equipment.

The standard scheme proposes the use of an identification mark made up of three distinct parts: (a) an identifying band of color or a solid color for the entire line which indicates to which of the main classifications the material belong; (b) a stenciled legend, abbreviated or otherwise, placed on the color band and naming the material carried; and/or (c) where desired, additional colored stripes of contrasting hues at the edge of the color band. These identification marks shall be placed at intervals throughout the piping system to ensure ready identification during repair operations and in an emergency.

Schematic Diagram for Identification of Colors

The colors allotted under (a) above are as follows:

Safe products	Green or the achromatic colors, white, black, gray, or aluminum
Dangerous materials	Yellow or orange
Protective materials	Bright blue
Extra valuable materials	Deep purple
Fire-protection equipment	Red

In any complete color scheme of this sort the natural basis is the solar spectrum and the spectral hues may be grouped in their natural order in the form of a circle. The illustration shows the arrangement of colors.

The committee suggests the following pigments for use:

No. 1—Toluidin Red. Fairly fast to aqueous acids, alkalis, and sulphur. Adds to the life of vehicles.

No. 2—Paranitranilin Red. Similar to the toluidin and cheaper, but has a slight solubility in the vehicle.

No. 3. A mixed pigment consisting of an organic red similar to toluidin mixed with zinc yellow. Fast to alkalis and sulphur but not to acids. Mixed with cadmium yellow in place of the zinc yellow it becomes fast to acids as well.

No. 4. Orange-Chrome Yellow. The regular color for ordinary use. Fast to alkalis but not to acids or sulphur.

No. 5. Yellow ochre toned up with bright yellow. Where chrome yellows cannot be used this is a good low-priced pigment and is fast to everything.

No. 6—Cadmium Lithopone. A combination of cadmium sulphide and blanc fixe. Fast to everything, but the available supply is limited and the cost high.

No. 7—Chrome Yellow Lemon. For general use. Fast to acids but not to caustic alkali or sulphur.

No. 8. Chrome oxide toned up with a little yellow. A moderately low-priced oxide and fast to everything.

No. 9—Ordinary Chrome Green Light. Fast to weak acids but not to alkali or sulphur.

No. 10. Prussian blue tint with a base white of Titanox. Fast to acid, fairly resistant to sulphur, easily affected by alkali.

No. 11. Ultramarine blue tint with a base white of zinc oxide. Fast to alkalis and sulphur but not to acids.

No. 12. Base white of Titanox tinted with alizarine purple. Fast to everything.

For outside exposure linseed oil is the most durable vehicle. Where higher resistance to water is required and for interior use tung oil varnishes may be used.

In the matter of further and complete identification the Committee finally arrived at the conclusion that such marking should consist principally of a lettered legend, abbreviated or otherwise, naming the material carried in the pipe line. The following letter sizes were adopted:

Outside Diameter of Pipe or Covering	Size of Stencil Letter	Outside Diameter of Pipe or Covering	Size of Stencil Letter
¾" — 1¼"	½"	6"	1¼"
1½" — 2"	¾"	7"	2"
2½" — 3"	¾"	8" —9"	2½"
3½" — 4"	1¼"	10" —11"	3"
4½" — 5"	1¼"	12" and over	3½"

Chemical Engineer's Bookshelf

Dyeing of Fabrics

The Dyeing of Textile Fibers. By *R. S. Horsfall* and *L. G. Lawrie*. D. Van Nostrand Company, New York. 415 pp. Price, $9.00.

The Dyeing of Cotton Fabrics. By *A. J. Hall*. D. Van Nostrand Company, New York. 296 pp. Price, $5.00.

Reviewed by Charles E. Mullin

MOST books upon dyeing treat the subject from the viewpoint of the dyestuffs, rather than from that of the fibers to be dyed. Horsfall and Lawrie have written from the latter standpoint and the result is an exceptionally interesting and complete book. Their scheme allows a brief discussion of the fibers and their properties before taking up the principles involved in dyeing them and the actual dyeing operations.

The book is divided into sixteen chapters. The introductory, which constitutes the first chapter, covers much more than the usual introduction, and besides the historical survey of the art of dyeing, covers color, its measurement, color blending and harmony, as well as an excellent review of the theories advanced to explain the phenomenon of dyeing. Chapter II covers the characteristics, physical and chemical properties of cotton, organdie and similar finishes, and immunized cotton. Chapter III briefly covers singeing, bleaching and mercerizing. The actual dyeing of cotton, as well as the machinery involved, is covered in Chapter IV, of about 100 pages. Chapter V covers the bast fibers. The rayons and rayon dyeing are discussed in Chapter VI.

Chapters VII and VIII cover the characteristics, physical and chemical properties of wool, while Chapter IX gives an excellent account of the various dyestuffs used upon wool, the methods and machinery used in their application, and more briefly, wool finishing processes. The chief characteristics of silk, its physical and chemical properties, processes previous to dyeing, its dyestuffs and their application, are considered in Chapter XI.

Chapter XII is entirely devoted to indigo and the new solubilized vat dyestuffs. Chapter XIII gives an excellent account of dyestuff valuation and the various fastness tests. Water and water softening processes are discussed, in relation to dyeing, in Chapter XIV; while the various protecting agents, dispersing agents, wetting-out agents, organic solvents, and other more common dyehouse reagents are covered in Chapter XV. The usual tables useful to dyers are found in Chapter XVI.

The book is well balanced, lucid and readable. Among the interesting and valuable features, frequently neglected by technical authors, are the references at the end of each chapter and the bibliography at the end of the book. It is well indexed and has an unusual feature in the special dyestuffs index, which is especially desirable and valuable in this particular book due to its arrangement and method of treating the subject.

"The Dyeing of Cotton Fabrics" really constitutes the third edition of Beech's book upon the same subject. Mr. Hall, the author of the present edition, needs no introduction to the textile industry of America as he has made numerous contributions to the technical literature, both in America and abroad. The book is divided into ten chapters. Chapter I covers the structure of the cotton fiber; Chapter II the bleaching of cotton, and stains and damages in bleached goods. Dyeing machinery and manipulations are covered in Chapter III. The principles and practice of cotton dyeing, including an abundance of color formulas, are discussed in Chapter IV, covering 122 pages. The dyeing of unions is considered in Chapters V and VI, the former treating cotton and wool, and the latter cotton and silk.

To the average dyer, probably the most interesting section of the book is Chapter VII, covering the dyeing of the rayons. The author is especially qualified to write upon this subject and while that which is given is of the best, it is all too brief. The operations following dyeing, i.e., washing, soaping, hydroextracting, steaming, drying, etc., are discussed in Chapter VIII; and the testing of color fastness is considered in Chapter IX. Chapter X covers experimental dyeing and the evaluation of dyestuffs. An excellent index forms a valuable feature of the book.

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Patents

Patents. By *R. S. Hoar*. The Ronald Press Company, New York. 232 pp. Price, $4.50.

Reviewed by Bruce K. Brown

The book is intended to advise the business executive,—to tell him what he should know and what he should do in the patent field. Chapters 7 and 8 on "Tactics" and "Interferences" are good in this respect and throughout the text there occasionally appear pointed paragraphs that explode many popular misconceptions.

The text is badly unbalanced,—so much so that a better title would be "What an Official of a Machinery Manufacturing Company Should Know about Patents." "Processes" and "Compositions" received scant attention, if any; and consequently it is not surprising to find that there is no adequate treatment of prior publications as references. Practically all of the specific examples and law points cited are in the machinery art and the continual stress laid on patents as anticipatory matter tends to lead the uninformed astray.

Patent attorneys will question some of the points of law expounded, for instance the confusion of two infringement defences at pages 29-30. The plan laid down for the organization of a "Patent Department" is quite different from that in vogue in most of the large chemical corporations.

Unusual effort has been expended to make the book readable and there is an elaborate and helpful series of cross references.

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The Essential Oils. By *Horace Finnemore*. D. Van Nostrand Company, Inc., New York. 880 pp. Price, $20.

The book is a comprehensive compilation of available chemical data on the essential oils, giving the known constituents of these oils, the methods by which these constituents were determined to be present, and where

available, the authority or discoverer of the constituent. The material is arranged under 56 divisions according to botanical family groups. Each oil is treated in a separate sub-division. The source of the oil and method of extraction are given, together with any plant characteristics that tend to change the character of the oil. In many cases the commercial substitutes or adulterants of the oil are given. In the case of the most important commercial oils the subjects of cultivation of the plant and production of the oil is taken up in more detail.

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Edible Oils

THE CHEMISTRY AND EXAMINATION OF EDIBLE OILS AND FATS, THEIR SUBSTITUTES AND ADULTERANTS. By *G. D. Elsdon*, Lancashire County Analyst. D. Van Nostrand Company, Inc., New York. 521 pp. Price, $12.50.

Reviewed by DAVID WESSON

IN LOOKING over the book one is immediately impressed with the great amount of information between its covers. In some respects it might almost be called a compendium of all the material relating to the subject to be found in the *Journal of the Society of Chemical Industry* and *The Analyst*. It contains 273 tables in the text and nine more in the seven appendices.

As indicated by the title, the book largely deals with analytical data, and goes very fully into the various factors affecting the same, as illustrated in the following instances: Composition of fat from various parts of a hog; variations in constants from the same animal; fatty acids from the same animal; fatty acids in butter fat from cows in different periods of lactation; effect of diet on fat of animals.

Hydrogenated oils have been treated in a separate chapter which is a valuable resumé of their properties.

As an example of the thoroughness with which the different oils are treated, thirteen pages are given to cottonseed oil. Leaving out the technology, of which there is little, and which is not satisfying, the analytical information is up to date and valuable.

Like many European publications the binding is poor; paper and typographical work are good.

The author's co-workers, E. R. Bolton, C. A. Mitchell, A. W. Knapp, J. A. Sutcliffe, and J. R. Stubbe, fully insure the value of the work as authoritative. It merits a place in the library of every chemist interested in the analysis of fats and oils.

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Minerals in 1926

THE MINERAL INDUSTRY, its Statistics, Technology and Trade during 1926. Volume XXXV. Edited by *G. A. Roush*, Associate Editor, *Allison Butts*. McGraw-Hill Book Company, Inc., 878 pages. Price, $12.

Since its inception in 1892 thirty-five volumes have appeared in this impressive series of annual reviews of minerals and metals. Few other industries have available for their use such a comprehensive record of statistics and technical progress. Since these volumes deal with many of the raw materials of chemical industry, they also offer a fund of useful economic information to the chemical manufacturer or to anyone intending to enter that field. In addition to the forty-five specialized chapters in which competent authorities discuss the individual commodity groups, there are almost 100 pages of mineral statistics from the principal countries of the world.

PHOSPHORIC ACID, PHOSPHATES AND PHOSPHATIC FERTILIZERS. By *Wm. H. Waggaman*, scientist in fertilizer investigations, Bureau of Soils, U. S. Department of Agriculture, assisted by *Henry W. Easterwood*, formerly chemist, Bureau of Soils, U. S. Department of Agriculture. American Chemical Society, Monograph Series. The Chemical Catalog Company, Inc., New York. 370 pp. Price, $7.50.

The authors of "Phosphoric Acid, Phosphates and Phosphatic Fertilizers" have performed a useful service by compiling and critically reviewing the extensive literature on this subject. Opening with a description of elemental phosphorus, phosphorus oxides and acids, the authors discuss the phosphate resources of the United States and of the world. This is followed by chapters on the manufacture of phosphates and phosphoric acid, including a discussion of comparative advantages of the sulphuric acid and volatilization processes. Three chapters on uses of phosphates and phosphoric acid conclude the text material. Perhaps the most valuable feature of the book is an excellent patent list, 23 pages long, which appears to be for most purposes inclusive, at least as regards United States patents.

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CHEMICAL ENGINEERING CATALOG. Twelfth Annual Edition, 1927. The Chemical Catalog Company, Inc., New York. 1160 pp. Price, $3.

The 1927 edition of the Chemical Engineering Catalog upholds the high standard of previous issues. Because this work is so well known and so widely used throughout the chemical engineering industries, little else need be said of it. Revised and brought up to date, it remains the standard equipment and material catalog in its field.

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BROWN'S DIRECTORY OF AMERICAN GAS COMPANIES AND GAS ENGINEERING AND APPLIANCE CATALOGUE. 1927 Edition. Robbins Publishing Company, Inc., New York. 828 pp. Price, $10.

Brown's Directory is a standard reference work for all those interested in the gas industry. The statistical section on gas companies and the directories of gas companies and members of gas associations are particularly useful and complete. In addition, the condensed catalog section contains an increased fund of information on equipment, appliances and materials.

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GENERAL CHEMISTRY, THEORETICAL AND DESCRIPTIVE. By *Thomas P. McCutcheon*, professor of inorganic chemistry, University of Pennsylvania, and *Harry Seltz*, assistant professor of physical chemistry, Carnegie Institute of Technology. D. Van Nostrand Company, New York. 415 pp. Price $3.50.

The author has produced a book intended for students of general chemistry. The book is divided into two parts, the first part being an exposition of the theory, and the second part is the familiar descriptive chemistry. The book should be useful to instructors who prefer a foundation of theory, even in the freshman year.

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SYNTHETIC RUBBER. By *S. P. Schotz*, consulting chemist and chemical engineer. D. Van Nostrand Company, New York. 144 pp. Price $6.

The author discusses the following subjects: raw materials for the production of synthetic rubber (isoprene, butadiene and dimethylbutadiene); the polymerization of the foregoing raw materials; vulcanization; stabilization; properties and constitution of natural caoutchouc and synthetic rubber; and the history of synthetic rubber.

Selections from Recent Literature

BENZALDEHYDE PRESERVATIVE. Max Brunner. *Helvetica Chimica Acta,* Oct., pp. 707-28. Various anti-oxygenic agents were tried for their effect on the "induction period" of the autoxidation of benzaldehyde. Iodine, hydroquinone and diphenylamine were found to be particularly effective. Benzoic acid has some retarding effect, especially if activated with iodine. The results are considered to be applicable to many easily oxidizable substances. The theory of autoxidation and anti-oxygen action is discussed in detail.

ANTHRAQUINONES. Arthur Locher and Hans E. Fierz. *Helvetica Chimica Acta,* Oct., pp. 642-70. 2-Methylanthraquinone cannot be directly sulphonated. 1-Nitro-2-methylanthraquinone, unlike its isomers, is stable to boiling aqueous Na_2SO_3. The sulphite method yields 2-methyl-1-anthraquinone sulphonic acid only at high temperature; Cu favors the reaction but Fe retards it. Some other derivatives of 1-nitro-2-methylanthraquinone are described.

REINFORCED CONCRETE. Julius Meyer and Kurt Pukall. *Chemiker-Zeitung,* Oct. 1, pp. 757-8. A study was made of the action of cement and gypsum plaster on Al, Mg, Ca and their alloys. Of these, Mg showed the most resistance of the three metals, but not enough to be safe in any structural use with cement or plaster. If the light metals are to be used at all it must be only after proper preliminary tests and with due caution.

CAUSTICIZING SODA. Hirchberg. *Chemiker-Zeitung,* Oct. 5, p. 765. The Blattner process, an improvement on the Löwig process, has showed sufficient promise in trials so that an experimental plant is being built. A metal oxide which liberates CO_2 is used for causticizing, and the CO_2 is recovered by absorption in Na_2CO_3 solution and calcination of the bicarbonate precipitate.

SULPHITE CELLULOSE. Erik Hagglund and Torsten Johnson. *Zeitschrift für angewandte Chemie,* Oct. 6, pp. 1101-4. The relation between fluorescence and reddening is studied in detail. The violet fluorescence (entirely distinct from the violet color imparted to wood by some acids) is due to some lignosulphonic acid group or component which is readily oxidized. The red color appears after oxidation destroys fluorescence.

OXIDIZING AMMONIA. Leonid Andrussow. *Zeitschrift für anorganische Chemie,* Sept., pp. 60-2. The influence of alkaline surfaces, which tend to oxidize NH_3 to nitrite-nitrate and not free nitrogen, is explained on the assumption that nitroxyl is first formed, and that the alkali immediately combines with it. Further oxidation then follows.

OXIDIZING AMMONIA. Leonid Andrussow. *Berichte,* Sept., pp. 2005-18. It is shown that the influences favoring formation of free nitrogen at the expense of the oxide yield can be very much lessened, e.g., by avoiding overheating of the catalyst, regulating the thickness of catalyst layers, and adjusting conditions so as to extend the optimum temperature range to the lowest possible temperature. Curves and tables are given.

ALDEHYDE-ANILINE. A. E. Chichibabin and M. P. Oparina. *Berichte,* Sept., pp. 1873-6. Evidence is offered to show that the Skraup reaction is only a special case of the Doebner and von Miller and the Chichibabin reactions for making substituted quinolines. As a contact agent, Al_2O_3 favors formation of lepidine compounds in the reaction of acetaldehyde with aniline and the like.

ELECTROPLATING. S. Wernick. *Industrial Chemist,* Sept., pp. 385-8. Illustrated account of factors governing adhesion of deposit, porosity, uniformity, soundness and covering power, and precautions to be observed in coating metals to prevent corrosion.

ISOPROPYL ALCOHOL. Harvey S. Garlick. *Industrial Chemist,* Sept., pp. 392-4. Occurrence, properties, manufacture and commercial uses; petroleum and acetone as raw materials; chemical derivatives; probable future developments.

BY-PRODUCT RECOVERY. R. Gunderson. *Industrial Chemist,* Sept., pp. 397-402. Illustrated description of current British practice in by-product distillation (still process) in coke plants.

SYNTHETIC AMMONIA. Howard W. Strong. *Industrial Chemist,* Sept., pp. 403-5. Illustrated description of the Badische works at Oppau; published by permission of the I. G.

WOOD PRESERVATION. R. Nowotny. *Zeitschrift für angewandte Chemie,* Sept. 22, pp. 1060-2. Experimental proof is given that water-soluble wood preservatives, e. g. $ZnCl_2$, continue to penetrate deeped into wood, such as telegraph poles, during storage after treatment. This fact is considered to be particularly important for the new "cobra" process of treating wood.

CARBON IN STEEL. P. W. Doehmer. *Chemiker-Zeitung,* Sept. 21, pp. 725-6. A brief review of the composition, analysis and evaluation of materials used to harden steel (introduce carbon). Leather char is one of the best, but is too expensive for general use. The materials used in Germany and America are essentially the same, except that dextrin or wax is commonly used as a binder in America.

ROTARY TUBE FURNACES. Schuster. *Chemiker-Zeitung,* Sept. 14, p. 710; Sept. 21, pp. 727-8. Description of construction and uses. Powdered coal is favored as fuel, but gas is also used.

PIGMENTS. B. Scheifele. *Farbe und Lack,* Sept. 14, pp. 484-5; Sept. 21, p. 495. The influence of particle size and distribution in paint and lacquer films is discussed. Cubic and tetrahedral packing of pigment particles are discussed. Hiding power and covering power as affected by these factors are similar but not identical. Illustrated.

ASPIRIN. *Chemiker-Zeitung,* Sept. 28, pp. 748-9. Description of the construction and operation of a battery of six acetylating units fitted for recovery of benzene and acetic acid.

REFUSE DISPOSAL. Rollo K. Newman. *Chemistry and Industry,* Sept. 30, pp. 877-80. Description of a combined separation-incineration system used by the city of Sydney, Australia, for disposing of rubbish and garbage. Products include fertilizer, scrap metal, cheap grease and fuel.

SYNTHETIC ALCOHOL. Paul Pascal. *Revue generale des matieres plastiques,* Oct., pp. 609-17. For making alcohol from C_2H_2 the method of hydration to aldehyde followed by reduction was chosen in preference to reducing (ethylene) and then hydrating. In factory operation the steps are: continuous aldehyde formation; discontinuous polymerization; electrolytic reduction in acid; catalyst recovery by electrolytic oxidation, and mercury recovery by chemical means.

SUGAR. H. I. Waterman and J. S. A. J. M. van Aken. *Journal of the Society of Chemical Industry,* Oct. 21, pp. 411-3T. A study of lime precipitation in sugar solutions, in the Steffen process of making sugar from molasses. Colloidal phenomena are involved, and the experimental results support the opinion of Ostwald and others that the colloidal solubility depends on the amount of undissolved matter, sucrose being the peptizer.

CUMARONE RESINS. T. Hedley Barry. *Industrial Chemist,* Oct., pp. 431-2. A review and discussion of recent patent literature.

CHAMBER PROCESS. W. H. Ibbotson. *Industrial Chemist,* Oct., pp. 437-40. One of the weaknesses of the chamber process of making H_2SO_4 is the low efficiency of recovery of oxides of N. Some of the chief sources of loss are discussed, and methods of prevention are considered.

RING TUNNEL FURNACE. K. Schmarje. *Chemiker-Zeitung,* Oct. 12, pp. 784-6. Illustrated description of the ring tunnel coking arrangement, and the most efficient method of operation.

ANTIMONY ENAMELS. Ferdinand Flury. *Zeitschrift für angewandte Chemie,* Oct. 13, pp. 1134-6. The weight of evidence favors the conclusion that antimony in enameled cooking ware may be given off in food in harmful amounts. As long as a doubt exists, it should be resolved against the use of antimony.

ELECTROLYTIC ZINC. H. Paweck and H. Wenzl. *Zeitschrift für angewandte Chemie,* Oct. 6, pp. 1106-12. A description, with diagrams of apparatus, for electrolytic deposition of Zn from roasted pyrites with high and with low Cu content. The usual sulphate process is not suitable for every variety of high Zn pyrites; therefore a system was worked

out for altering the procedure in conformity with the Cu content, to give the best results at lowest cost.

POROUS SILICA. Helmut Wolter. *Zeitschrift für angewandte Chemie*, Oct. 6, pp. 1113-5. A review, in which 8 selected methods of making porous silica from water glass are mentioned. Tabasheer, kieselguhr and like products are considered. So also are products derived from plant ashes.

NICKEL ANODES. F. Foerster and F. Krueger. *Zeitschrift für Elektrochemie*, Oct., pp. 406-23; discussion, pp. 423-5. Behavior of Ni anodes in sulphate solutions containing Cl ion; theoretical and practical significance of pH changes during electroplating; effect of certain conditions on the character of the deposit. Illustrated.

CALCIUM CYANAMIDE. H. Franck and H. Heimann. *Zeitschrift für Elektrochemie*, Oct., pp. 469-75. The dissociation equilibrium of Ca cyanamide was studied, and N_2 pressure curves were plotted. The solid phase contains a solid solution of Ca cyanamide and Ca carbide.

SILICA GEL. *Chemistry and Industry*, Oct. 7, pp. 902-4. A short illustrated account of an application of silica gel to the drying of air for a blast furnace. Advantages over freezing and chemical absorption methods are claimed. See also *Industrial Chemist*, Oct., pp. 441-51.

INSULATING OILS. Cecil O. Harvey. *Chemistry and Industry*, Oct. 7, pp. 904-6. Transformer oils and the like must be thoroughly free from impurities which impair electrical resistance; e. g. as little as 0.005 per cent water may be detrimental. Deterioration generally involves one or more of three kinds of sludge formation: asphaltic, soap and carbon sludge. There is no entirely satisfactory test for performance characteristics, but there is a possibility that significant results may be obtained from absorption spectra.

ZINC CORROSION. W. S. Patterson. *Journal of the Society of Chemical Industry*, Oct. 7, pp. 390-6T. The chief difference between atmospheric corrosion of Zn and Fe is that the scale formed on Fe is deliquescent and does not retard further rusting, whereas the scale on Zn is not deliquescent and forms a protective film. Of metal impurities, lead protects, cadmium and iron have no effect and copper and tin accelerate corrosion.

HYDROCHLORIC ACID. Henry O. Askew. *Journal of the Society of Chemical Industry*, Oct. 7, pp. 386-90T. A method of calculating coefficients of absorption of HCl in water is derived from experimental data and discussed. In simple solutions the absorption rate is governed by the gas film. The coefficient is nearly the same for a capillary-active film and for an air film, but increases greatly in presence of an alkaline film.

SPRAY DRYING. J. A. Reavell. *Chemistry and Industry*, Oct. 14, pp. 925-30 and Oct. 21, pp. 951-7. Illustrated description of an application of spray drying and discussion of the equipment used to obtain particular effects.

BENZENE RECOVERY. F. Raschig. *Zeitschrift für angewandte Chemie*, Sept. 29, pp. 1089-90. An account of how the vacuum distillation method patented by Hartmann (actually invented by Erlenbach) was reduced to practice on a commercial scale at the Koppers plant in Essen.

FRACTIONATION. L. Gay. *Chimie et Industrie*, Sept., pp. 381-93. Numerical application of theoretical considerations previously published. A mixture of ethyl, n-propyl, primary butyl and isoamyl alcohols was chosen as nearly ideal. The results are applicable to more complex mixtures of these alcohols and their isomers, provided primary and secondary isobutyl alcohols are absent or present only in negligible amounts. It is shown that the distiller can choose in advance that one of the five possible procedures which is most suitable for the mixture to be fractionated.

WINDOW GLASS. Babille. *Chimie et Industrie*, Sept., pp. 371-80. The Fourcault process is compared with the Libbey-Owens process. Both have the advantages of labor saving and improved quality, with ready adaptability to any thickness in commercial use. The striation difficulty is being overcome by mechanical improvements in both. The Libbey-Owens machine is even more complicated than the Fourcault, and has a somewhat higher upkeep cost. Both processes are gaining ground concurrently as compared with other processes. Illustrated.

ULTRAMARINE. Hans Hadert. *Farbe und Lack*, Sept 28, p. 506; Oct. 5, pp. 520-1; Oct. 12, pp. 532-3. A description of ultramarine pigments; methods of manufacture, and machinery used (mills, furnaces, etc.). Illustrated.

NITROCELLULOSE SOLVENTS. A. Cobenzl. *Farbe und Lack*, Oct. 5, p. 519. The cellulose plastics industries should take due advantage of the remarkable property of quinoline and the pyridine bases, of altering dissolved cellulose esters in such a way that viscosity falls off with time and the solution acquires capacity for dissolving a new quantity of the ester. For example, as much as 40 g. of collodion can be dissolved in 50 g. of pyridine by this repetition process.

TYPEWRITER INK. Bruno Walther. *Farbe und Lack*, Oct. 5, p. 510. Recipes and methods of manufacture are given in detail.

LIGNITE STRUCTURE. J. Marcusson. *Zeitschrift für angewandte Chemie*, Oct. 6, pp. 1104-6. Lignites are classed as alkali-soluble and alkali-insoluble, and the chemical differences of the two are considered. Good and poor grades were examined.

DYEING. Kurt Brass. *Zeitschrift für angewandte Chemie*, Oct. 27, pp. 1218-25. The solubility of many compounds of the phenolic type in cellulose is an important factor in the application of many dyes including vat, sulphur and mordant dyes. Surface state of the cellulose has some influence; the partition coefficient increases in the order: purified cotton, pure cotton cellulose, bleached mercerized cotton, cuprammonium silk, viscose. Various practical applications are discussed.

BERYLLIUM. Kurt Illig. *Zeitschrift für angewandte Chemie*, Oct. 20, pp. 1160-3. The preparation of Be metal by the Stock-Goldschmidt electrolytic process is described. Pure Be has only limited uses; but in alloys, particularly with copper and nickel, it shows much promise.

Government Publications

Prices indicated are charged by the Superintendent of Documents, Washington, D. C., for pamphlets. Send cash or money order; stamps and personal checks not accepted. When no price is indicated pamphlet is free and should be ordered from Bureau responsible for issue.

Studies of the Efficiency of Water Purification Processes, by H. W. Streeter. Public Health Service Bulletin 127. $1.00.

Magnetic Concentration of Iron Ores of Alabama, by Oscar Lee, B. W. Gandrud, and F. D. DeVaney. Bureau of Mines Bulletin 278. 20 cents.

Asbestos Paper and Asbestos Millboard. Department of Commerce Simplified Practice Recommendation 19 (First Revision). 5 cents.

Comparison of Oils Derived from Coal and from Oil Shale, by Joseph W. Horne and Arthur D. Bauer. Bureau of Mines Serial 2832.

Production statistics from 1925 Census of Manufactures—printed pamphlets on: Iron and Steel, 10 cents; Manufactures of Nonferrous Metals and Alloys (Except Precious Metals), 5 cents; and Miscellaneous Food Products, 5 cents.

American Forests and Forest Products. U. S. Department of Agriculture Statistical Bulletin 21. 45 cents.

The Jerusalem Artichoke as a Crop Plant, by D. N. Shoemaker. U. S. Department of Agriculture Technical Bulletin 33. 5 cents.

List of Technical Workers in the Department of Agriculture, and Outline of Functions of Major Branches of the Department, 1927. U. S. Department of Agriculture Office of Personnel and Business Administration Miscellaneous Publication 5.

Sources and Distribution of Major Petroleum Products, Atlantic Coast States—1926, by E. B. Swanson. Bureau of Mines Information Circular 6050.

Railroad Fuel Oil Consumption in 1926, by Arthur Huber Redfield. Bureau of Mines Information Circular 6049.

Reduction of Breathing Losses from Vapor-Tight Lease Tanks, by Ludwig Schmidt. Bureau of Mines Serial 2834.

Instruction for Sampling Atmospheric Dust by the Impinger Method, by Alden H. Emery. Bureau of Mines Information Circular 6048.

The Detection of Sulphur in Petroleum and Petroleum Distillates, by F. W. Lane and John M. Devine. Bureau of Mines Serial 2828.

THE PLANT NOTEBOOK
an exchange for OPERATING MEN

Sulphur Dioxide Detector

A problem which is frequently encountered in sulphuric acid plants and in other places where there is a possibility of there being SO_2 losses in the stack gases, is that of finding a ready means for keeping a constant check on the losses and warning the operator when there is more SO_2 being vented than is permissible.

In the plant in which this device was used, there was a small and substantially constant discharge of SO_2 at all times. The SO_2 content of the exit gases was, however, variable and indicated something wrong with the system when it became too large. This percentage was found to vary between zero and one-half per cent of the vented gases. Since the loss of SO_2 did not necessarily indicate any incorrect operating condition, it was therefore necessary that the signal device should not indicate the presence of acidity in the gases due to this cause.

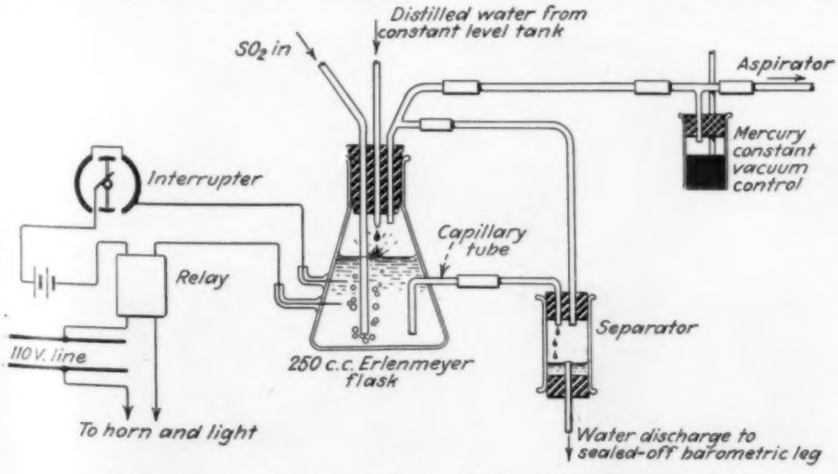
After a number of attempts, a nearly automatic system was perfected, as shown in the illustration. It has since met the demands of the situation very satisfactorily, and should be adaptable to other cases in which it is desired to detect a certain amount of water-soluble gas which may be present in a flue or stack. It is obvious that the gas must be one, such as ammonia or SO_2, which will, when in water solution, increase the conductivity of the water. It is also apparent that the temperature of the water must be maintained reasonably constant if the gas is one of low solubility.

It is evident from the drawing that water is allowed to drip into the flask from an overhead constant-level tank, and at a uniform rate. An unvarying vacuum is maintained on the flask by means of a mercury bottle, vented with a tube which is submerged under the mercury surface. The submergence of the tube controls the magnitude of the vacuum up to the capacity of the pump or aspirator. Thus, the amount of gas aspirated through the flask as well as the water inflow may be controlled.

Water discharges from the flask through a capillary tube at the same rate that it enters. This feeds into a separator, which is connected to the vacuum line and is drained by a sealed barometric leg. The latter may be regulated as to height, if necessary, although the rate of water discharge is controlled by the size of the capillary.

Two electrodes are sealed into the side of the flask below the water level and are connected to a source of current and a relay through an interrupter. When the amount of SO_2 in the aspirated gases becomes so large that the increased conductivity of the solution in the flask permits a sufficiently large current to flow to close the relay, then the relay completes a 110-volt circuit through a horn and lamp and warns the operator. It was found before the interrupter was installed that only 60 per cent of the current necessary to close the relay was required to hold it closed, and that consequently there was a considerable lag in the functioning of the warning after the SO_2 had been reduced below the danger point. Once the relay was closed, the warning continued until the SO_2 had dropped to such a point that the current was less than 60 per cent of that which flowed at the undesirable concentration. However, a simple commutator or interrupter which broke the relay primary circuit five times per minute easily solved this difficulty. Since the maximum current was always required to close the relay, the warning ceased as soon as the concentration dropped to a safe amount. This restored the operator's confidence in the device and speeded up operation. The interrupter was the only piece of equipment which was not found in the laboratory and this was constructed without difficulty by the plant mechanic. It was run from a convenient line shaft.

The presence of SO_2 in the gases did not affect the operation of the warning because, since it is only slightly soluble and is a constant quantity, it was compensated by proper control of the water flow. A trial and error method of titrating and measuring the volume of the effluent solution was necessary here in adjusting gas and water flow so that the proper concentration of sulphurous acid would result when the SO_2 concentration reached the proscribed amount. Nevertheless, the characteristics of the apparatus are such that the rates are automatically maintained once they are established, and require only an occasional check to insure accuracy.



Easily Constructed Warning Device for Detecting Sulphur Dioxide

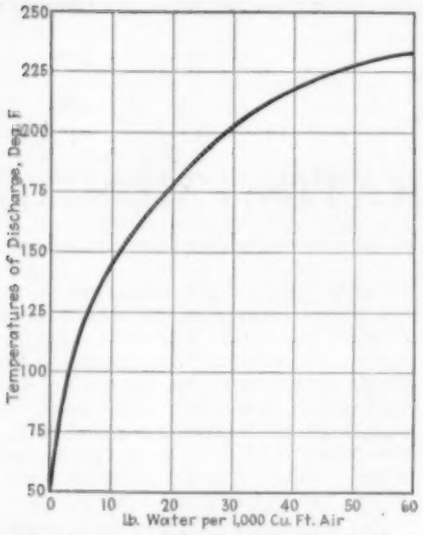
Freezing of Compressed Air Lines

By Fred Emmarr
Dayton, Ohio

We have often had trouble with the freezing of exposed compressed air lines during the winter. A short time ago this question came up and its remedies were discussed. One man suggested that the quantity of intercooler water circulated be decreased so as to put out air at higher temperatures, thus decreasing the possibility of freezing. It was very difficult to convince him that this would aggravate the condition and that more freezing would occur.

The accompanying curve was prepared to show that with increased discharge temperatures, more water was thrown into the air lines and the dew-point raised, greatly increasing the quantity of condensed water subject to freezing. This water would trap in the lines more readily and freeze solid more quickly. In the curve, the pounds of water carried by 1,000 cu.ft. of air is plotted against temperature, assuming complete saturation.

The only way to prevent freezing, where it is impossible to move the lines into warm buildings, is to cover them and to insure thorough drainage by sloping toward drips that are located in warmer places and trapped. In this way, the probably high velocity of the



Water Vapor-Carrying Capacity of Air at Various Temperatures

air will carry the condensed moisture through the exposed sections. At the same time, if these exposed lines are covered, not much drop in temperature will be experienced, within limits, due to its rapid travel.

Splash Shield

A new spash shield for acid carboy inclinators is being used by the General Electric plant in Ft. Wayne, Ind., and was adopted as a result of its suggestion system.

A rectangular piece of glass in a metal frame is fastened to the cross bar on top of the inclinator by removing the handle, placing the flange of the shield over the two bolts and replacing the handle. The shield is therefore integral with the inclinator, and it is not necessary to change it every time a carboy is removed. Such a shield, between six and seven inches wide and from eight to ten inches long, prevents acid from striking one in the eyes should it splash while being poured.

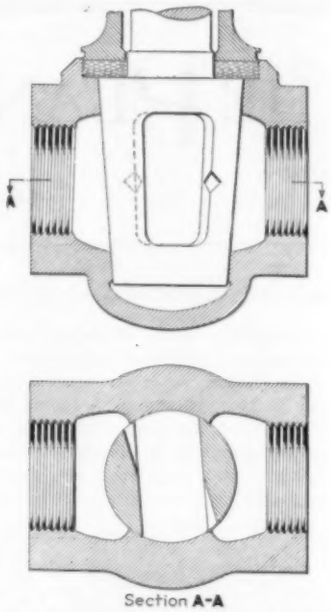
Splash Shield for Carboys

Easily Regulated Plug Cock

By L. C. Cooley
Swenson Evaporator Company

The accompanying sketch shows a simple method which may be very easily applied to any ordinary plug cock in order to make its regulation a simple and accurate matter. All that is necessary is to file a notch on either side of the plug port as shown. The notch may be of as wide or as narrow an angle as may be required in order to give sufficient flow at small regulation.

A quarter-in. plug cock which has been filed in this manner may, if equipped with a three-ft. handle, be adjusted to give a variable number of drops. A cock which controls an oil burner may be set to hold a furnace within a few degrees.



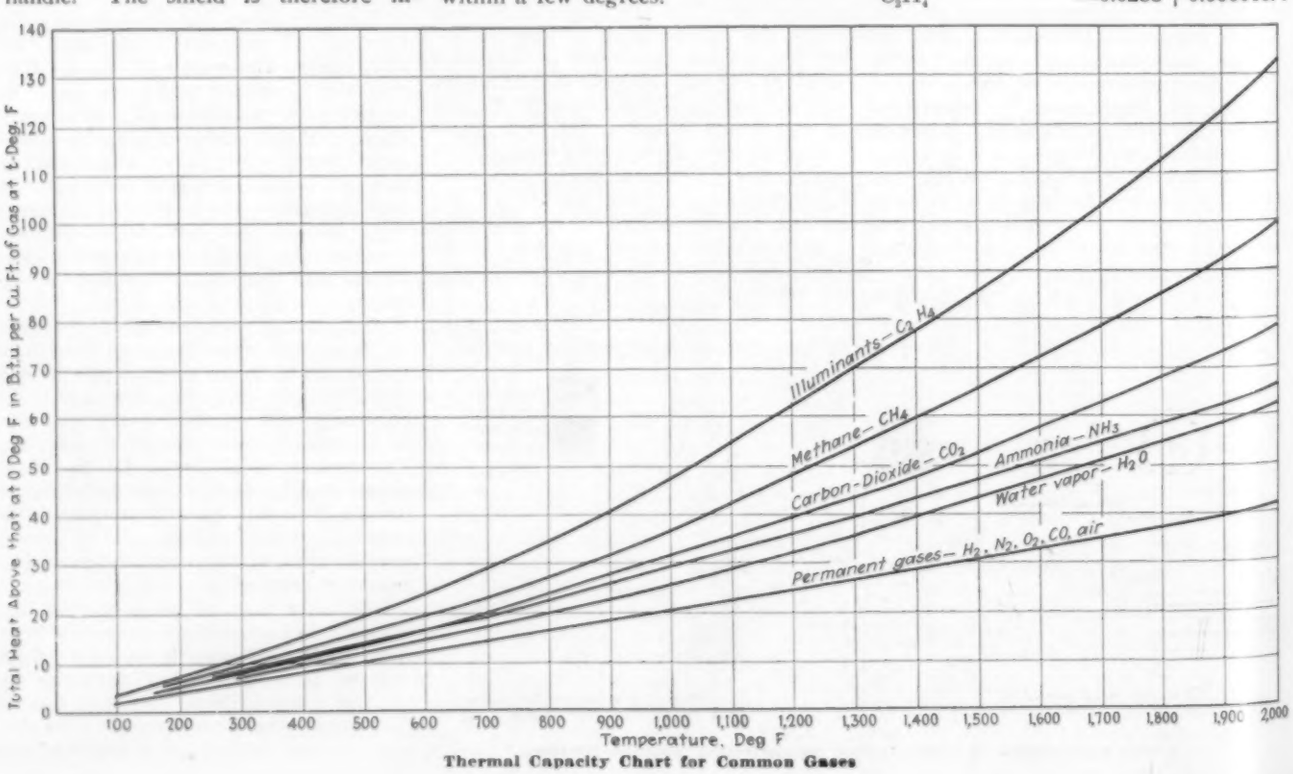
Triangular Notches Make Adjustment of a Plug Cock Easy

Thermal Capacity of Gases

By L. G. Jones
Baltimore, Md.

The accompanying set of curves gives in a convenient manner the heat capacities in B.t.u. above 0 deg. F. for various common gases. If greater accuracy is required the following equations may be used, up to 3,000 deg. F. capacity:

H_2, N_2, O_2, Co, Air $= 0.0189 + 0.0000009t$
Co_2 $= 0.023 + 0.000008t$
H_2O $= 0.021 + 0.000005t$
CH_4 $= 0.0251 + 0.0000124t$
C_2H_4 $= 0.0288 + 0.0000187t$



Thermal Capacity Chart for Common Gases

EQUIPMENT NEWS *from* MAKER *and* USER

Efficient Gas Burner

A new gas burner which employs a modification of the tunnel system of firing as applied to refractories and which utilizes the advantages of combustion in contact with hot refractory surfaces without flame impingement, has been developed by the Surface Combustion Company of Toledo, Ohio. The new burner finds its chief field of application in the firing of kettles and soft metal furnaces and is said also to have a variety of other uses. A number of the burners have been applied successfully in varnish manufacture.

In this latter field, before the advent of the tunnel-type burner, various kinds of gas burners and other heat supplying means were about on a parity because of the low utilization efficiency of the gas. The new burner, however, known as the Surface Combustion Flat Hexagon type has, claimed for it, an efficiency of 36.8 per cent, nearly four times that of coke. At the same time, the duration of the varnish cooking has been reduced to between one-third and one-quarter of that required for coke firing. While the improvement over oil firing and older types of gas burners is not so striking, it is nevertheless decided. The flat hexagon burner is 27 per cent faster than its nearest competitor.

Fig. 1 shows the construction of the burner in considerable detail. The radiant elements consist of hollow prismatic tile of hexagonal shape which are loosely packed, each over an orifice, on a flat circular metal diaphragm in which are the gas discharge ports. Six special refractory brick shapes bound the burner proper, and being higher than the tunnel tile, will prevent the latter from touching a kettle placed above. In operation gas is supplied at high pressure with automatic air-mixture control so that the combustion region is maintained near the top of the tunnels. By this means it is said that temperatures at the upper surface of the burner of 1,800 deg. F. to as high as 3,300 deg. F. may be maintained. Heating is accomplished through radiation and through transfer from the burned gases. The latter are, however, kept at a minimum consistent with complete combustion, by avoiding dilution with secondary air. As shown in Fig. 2 this is accomplished by raising the burner by means of a jack so that the radiant surface is an inch from the kettle when the latter is in place.

The manufacturers believe that the high efficiency and rapid heating obtainable with the burner coupled with the close control to which it is susceptible, make it of great utility wherever radiant heating is possible.

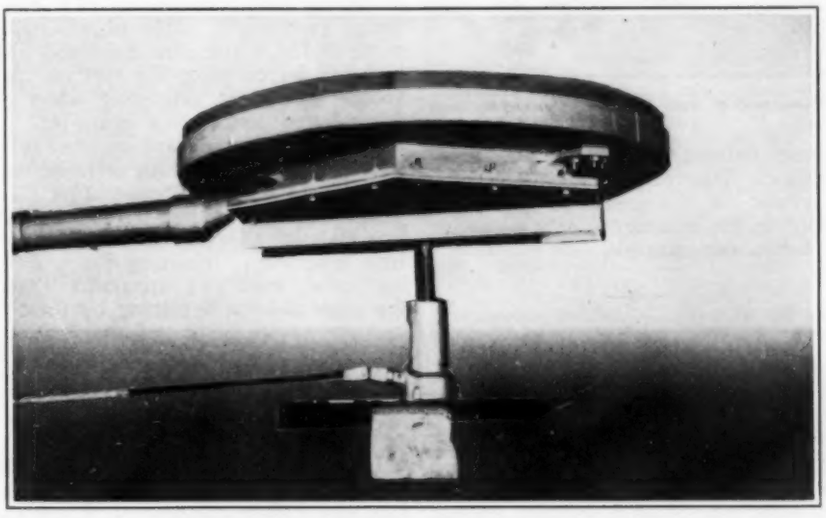


Fig. 2—Under View of the Burner Showing Lifting Jack

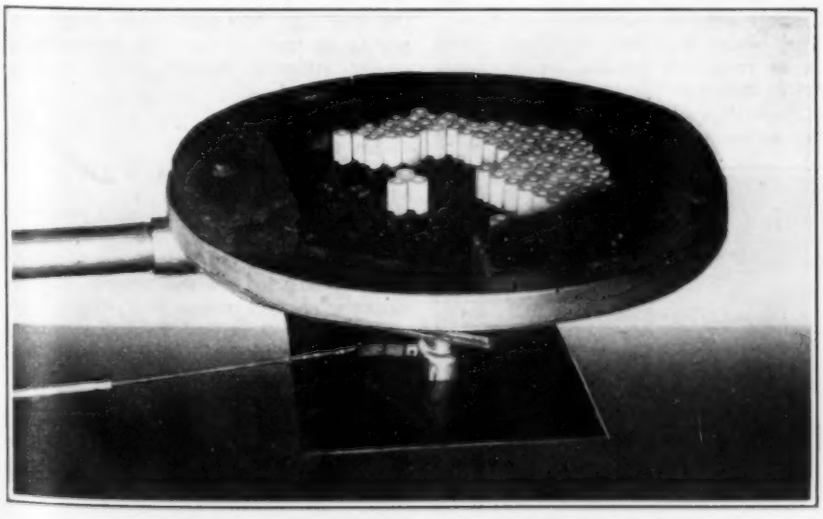


Fig. 1—Hexagonal Burner with Prisms Removed to Show Construction

Conveyor Carrier

The Stephens-Adamson Manufacturing Company, Aurora, Ill., has recently announced a new type of belt conveyor carrier which is said to embody a number of improvements in construction and design. The new carrier is known as the "Simplex," and the complete line includes carriers for belts ranging in width from 12 to 60 inches. The carrier proper consists of three rollers in line, the troughing rollers being mounted at 20 deg. to increase the capacity of the belt. The carriers are mounted on a heavy steel angle section base, which is self cleaning. The whole assembly is tilted slightly in the direction of belt travel, to facilitate training of the belt.

The rollers are made of steel tubing, furnished with drawn steel end plates. The ends of the rollers are rounded to protect the belt from wear. Each roller is equipped with two Timken bearings, mounted as indicated in the accompanying illustration. They are protected from dust by a combined labyrinth washer and multiple groove grease seal. Permanent adjustment of the bearings is provided by lock screws.

The rollers are made of steel tubing, iron stands, which support the shafts close to the bearings, and which are so constructed that it is easy to remove the rollers bodily. Each roller shaft is equipped with two high pressure

Disassembled Anti-Friction Conveyor Roll

grease fittings, which are readily accessible. The roll interior serves as a reservoir for the grease so that lubrication of the bearings is only necessary at infrequent intervals.

Water- and Rust-Proof Protective Coating

EDITOR'S NOTE: *Based upon an account which was brought to the attention of the editors by Mr. G. Angel, Bohus, Sweden, and which was presented in "Teknisk Tidskrift," the Swedish technical journal, Chem. & Met. publishes herewith a brief description of a new protective coating known as "Tillit," which has met with considerable success in England and on the continent.*

"Tillit" is a recently perfected covering material in the nature of a paint, which is composed of rubber, oxidized bitumen, and materials to produce rapid drying. The film which results from the use of the product as a coating is said to have excellent flexibility and adherence, and to retain these properties for long periods of time without becoming brittle, as does ordinary asphalt.

Tests which were conducted by the Metallographic Institute of Stockholm, and by the State Testing Laboratory of Stockholm at the instance of the Royal Swedish Water-Power Board, have shown decided superiority of the new product to paints of red lead and linseed oil. The coating appears to be entirely free from pores and is found to have very nearly perfect resistance to ordinary acids, moist and acid atmospheres and to sal-ammoniac solution. The covering capacity is more than twice that of red lead, while the drying time is reduced to one-sixth. The adhesion to the surface coated is such that after test it can only be removed by considerable effort. It is said to adhere equally well to surfaces which are damp or rusty at the time of painting and so may be applied in any kind of weather.

It is claimed that "Tillit" may be used as a water-proof and protecting coating for concrete, brick, wood and felted roofing, and as a rust-proofing for iron and other corrodable metals.

The selling rights for this material are controlled by Hugo Tillquist, Machine Agency, Stockholm, Sweden.

Portable Steam Generator

The Homestead Valve Manufacturing Company of Homestead, Pa., has recently brought out a new multi-purpose device which is known as the "Hypressure Jenny." While the equipment is ordinarily supplied for mounting directly on the floor, it may be adapted to portable use by mounting on a small truck or rolling body. It consists of a rapid steam generator capable of producing vapor at 150 lb. pressure, combined with a motor driven pump for fuel oil, and another pump for delivering water or any solution desired to a steam jet.

A hose and nozzle are supplied from which water or a cleaning solution may be blown at high temperature and velocity, thus providing a rapid means, it is claimed, for cleaning grease or dirt from machinery, removing paint, melting snow, sterilizing apparatus, thawing pipes and extinguishing oil fires.

Compressed Spruce Pulleys and Gears

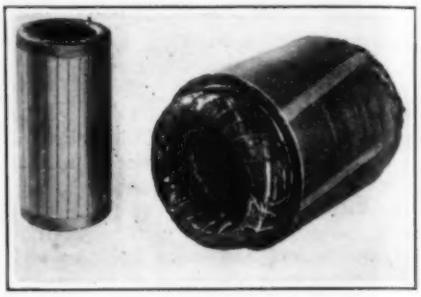
Laminated spruce blocks are being used by the Compressed Spruce Products Company, West Orange, N. J., in the manufacture of a wide variety of sizes of gears and pulleys. The manufacturers state that the pulleys so formed possess a long life, are substantially weather-proof, and have an abnormally high coefficient of friction. Both gears and pulleys are said to be capable of accurate balance and are consequently usable at high speeds. They are also extremely light in weight.

Fig. 1—Partially Compressed Spruce Block

The blocks are built up from short ends of re-sawed lumber, of thickness varying between one-quarter and one-half inch dependent upon the width of pulley to be made. Alternate boards are placed with the grain running at right angles. A casein-base binder is used which is said to be waterproof. The blocks are then compressed to between 75 and 25 per cent of the original, according to the use to which the pulley is to be put, under 4,000 tons hydraulic pressure, after which the reduction in thickness is set by clamping the block for a sufficient time to make it permanent. Fig. 1 shows the appearance of a compressed block as compared with the original.

Fig. 2 illustrates one of the larger pulleys in operation. The pulleys may be supplied in any size up to 48 in. in diameter.

Fig. 2—Compressed Spruce Pulley on a 250 hp. Motor



Rotor and Stator of Shell Type Motor

Shell Type Motor

The Lincoln Electric Company of Cleveland, Ohio, announces a new high speed squirrel cage motor shown in part in the accompanying illustration. It is of the so-called shell type, an all-welded design, and is supplied in two sizes, 3 hp. and 5 hp. Both motors are manufactured for either two or three phase, 60 cycle current and a speed of 3,600 r.p.m. The stator is composed of laminated sections arc-welded together. The rotor is also entirely arc-welded and provided either with straight or tapered bore.

The welding does away with the necessity of a solid shell about the laminations and also replaces the conventional rivets. The amount of active field is thus kept at a minimum. It is said that the effect of this is to increase the magnetic flux and allow more copper to be used in the slot, producing a cooler running motor which permits greater overload.

Electric Gas Valve

The Honeywell Heating Specialties Company, Wabash, Ind., has just introduced a new electrically controlled gas valve to be used for the remote or thermostatic control of gas flow where pressure does not exceed 12 in. of water. The valve is supplied in sizes from one-half to two inches.

In distinction to the usual type of solenoid valve, the one described is equipped with a small induction motor which lifts the valve disk plunger against the action of a Monel seating spring through the action of a train of duralumin gears. Voltage fluctuations

of less than 15 per cent will not affect the valve, but should the power fail entirely, the mechanism immediately closes. The valve may be reset manually. After the power resumes, the functioning of the thermostat is automatically taken up. A time delay feature in the operation prevents rapid opening and closing of the device due to building vibration or inexpert manipulation of the thermostat.

New Conveyor Belt

The B. F. Goodrich Rubber Company, of Akron, Ohio, have adopted a new construction for all their brands of

Section Across Highflex Belt

rubber covered conveyor and elevator belts. The new belt is called the "Highflex." It consists essentially in the elimination of all folds in laying up the fabric, each ply being a separate unit completely insulated from the adjoining plies.

This new construction was developed to meet the needs for the higher speeds and longer center distances now employed in conveyor practice. One of the problems involved in such installations is the maintenance of good contact on the driving pulleys without using excessive tension on the return side of the belt. It is claimed that the increase in flexibility afforded by the foldless construction improves pulley contact to a marked degree, as well as insuring a better distribution of tension between the plies and across the width of the belt.

In one installation of an 8 ply Highflex belt more than 2,000 ft. long it was found possible to operate the conveyor fully loaded without any tension on the return side of the belt, whereas with a folded belt of equal thickness on the same installation it had been necessary to use a gravity take-up to prevent excessive slip.

Another advantage claimed for the new construction is superior edge adhesion. A heavy edge cushion, continuous with the top cover, is united to the edges of the fabric so that the makers state that nothing short of destruction can separate the rubber from its anchorage. When the edge of the belt is gouged by an obstruction the bonded edge will not tear loose in strips.

Acid-Proof Filter

The dyestuffs division of E. I. du Pont de Nemours and Company at Wilmington, has recently introduced to the market a nitrocellulose acid-resistant filter which has been named the du Pont "Resisto-Filter." It is claimed for the new product that it is fully equal to that of foreign manufacture upon which reliance had previously to be placed, and that the life of the cloths is twelve times that of a good grade of wool and at least six times that of the best camel's hair. The tensile strength of the filters is 70 to 80 per cent of the strength of the cotton cloth from which they are made. They are satisfactory for use with sulphuric acid up to a strength of 60 per cent and a temperature of 100 deg. C. Economical use is also possible, it is held, with nitric and mixed acids as well as with hydrochloric. They may not, however, be used with solvents of nitrocellulose nor with caustics, alkali sulphides or strong reducing agents.

Due to the inflammable nature of the filters, they are shipped or stored in special containers and are kept immersed in water. When reasonable care is taken in handling the material and in destroying the worn-out cloths, it is maintained that no special hazard exists.

Manufacturers' Latest Publications

Shore Instrument & Mfg. Company, Van Wyck & Carll Sts., Jamaica, N. Y.—Preliminary bulletin M1—A pamphlet describing the Shore Standard Universal Hardness Indicator, known as the Monotron. This instrument may be used for the measurement of the hardness not only of metals, minerals and vitreous materials, but also of organic and compounded materials.

Bethlehem Steel Company, Bethlehem, Pa.—Catalog J—Describing the Bethlehem roll pulverizer and air separation system.

James Hunter Machine Company, North Adams, Mass.—Bulletin No. 252—Describing Hunter drying equipment. Dryers and accessories for a wide variety of uses are shown.

Master Electric Company, Dayton, Ohio. —Form 375—A pamphlet which describes the new Master Motor-Grinder.

Niagara Blower Company, 673 Ontario St., Buffalo, N. Y.—Bulletin No. 1—A leaflet which describes Niagara heating and ventilating units.

Truscon Laboratories, Detroit, Mich.—A new mailing piece describing Truscon waterproofing for steel, concrete and wood.

General Plastics Company, Inc., North Tonawanda, N. Y.—New booklet covering the history and the uses of "Durez."

American Blower Company, Detroit, Mich.—Form 6818—A booklet which describes the use of Venturafin Unit Heaters in the plant of the Oakland-Pontiac company.

National Electrical Manufacturers Association, 420 Lexington Ave., New York, N. Y.—October issue of Nema Handbook of Supply Standards.

American Rolling Mill Company, Middletown, Ohio.—A pamphlet entitled "Light on Your Rust Problems."

Pyrometer Instrument Company, 74 Reade St., New York, N. Y. — New pamphlets covering a simplified Pyro optical pyrometer and a new electric tachometer.

Duriron Company, Dayton, Ohio.—Bulletin 139-B—Duriron Digestion Equipment. Also, a new pamphlet on the use of Duriron in the refinery.

Armco Culvert Manufacturers Association, Middletown, Ohio.—A new publication entitled "Basing Confidence in Culvert Strength on Engineering Facts."

Linde Air Products Co., 30 East 42nd St., New York.—Publication entitled "Oxy-Acetylene Tips."

Chas. Engelhard Inc., 90 Chestnut St., Newark, N. J.—Reprint from "Combustion" on Engelhard CO_2 gas analysis and recorder equipment.

Imperial Institute, South Kensington, London, S. W.-7, England.—Reprint from "Engineering" on "An Adjustable Dash Pot for Cement Testing."

General Electric Company, Schenectady, N. Y.—Bulletins and publications as follows: GEA-23A, Disconnecting switches, type LG 17B; GEA-37B, Direct heat electric furnaces; GEA-573A, Automatic Switching Equipment; GEA-574A, Automatic Supervisory Equipment; GEA-716A, Totalizing Relay; GEA-776A, Method of Removing and Replacing Pinions; GEA-801, G. E. Oil Tempering Bath, electrically heated; GEA-822, Ball Bearing Construction for A.C. and D.C. General Purpose Motors; GEA-827, Capacitors for Power-Factor Correction; GEA-829, Type MF-2, Synchronous Timer; GEA-831, Manually Operated Field Switches; GEA-833, Direct-Current Printing Press Controllers; GEA-834, Controllers for A.C. Slip-ring Induction Motors; GEA-849, Magnet Frames; GEA-853, Solid vs. Split Gears for Railway and Industrial Haulage Motors; GEA-158A, A Bulletin on Portable Instruments; GEA-839, A Bulletin on Electrical Laboratory Apparatus and Educational Service.

Taber-Pump Co., Buffalo, N. Y.—Bulletin SL927—Detailed description and information concerning type SL double suction centrifugal pumps; mailing piece covering Taber motor driven centrifugal pumps.

Steacy-Schmidt Manufacturing Co., York, Pa.—Mailing piece on special machinery.

Stockham Pipe and Fitting Co., Birmingham, Ala.—October 1927 Catalog completely covering Stockham steel fittings for high pressures and temperatures.

American Rolling Mill Co., Middletown, Ohio.—A booklet entitled "Incidents in the Life of the American Rolling Mill Co."

Semet-Solvay Engineering Corp., 40 Rector St., New York, N. Y.—Pamphlets as follows: Pamphlet No. 324, Equipment for Removing Benzol; No. 325, Ammonia recovery apparatus; No. 326, Steere welded purifiers.

Atlas Valve Co., 282 South St., Newark, N. J.—Catalog describing the Campbell Boiler Feed Water Regulator.

Connersville Blower Co., Connersville, Ind.—Bulletin 33, on Victor Industrial Gas Boosters. Bulletin 50 on Renewable bearings for Connersville Blowers.

Edward A. Whaley & Co., Norfolk, Virginia. — Leaflet covering Whaley Laboratory Refining Machines, for use in the refining of crude vegetable oils.

Sturtevant Mill Co., Harrison Square, Boston, Mass. — Pamphlets as follows: Leaflet on the "Whirlwind Centrifugal Selector," Sturtevant Laboratory mills and crushers; "Open Door" mixers.

United Cork Companies, Lyndhurst, N. J. —Handbook A. I. A. File No. 37-a-1, entitled "Facts and Figures on Insulations." Relates to insulation for refrigeration purposes.

Philip-Carey Co., Cincinnati, O.—Bulletin 101A—Heat insulation for temperatures 500 deg. F. to 1200 deg. F.

Reeves Pulley Co., Columbus, Ind. — Mailing piece describing Catalog T-66 on Reeves variable speed transmissions.

De Laval Steam Turbine Co., Trenton, N. J.—Catalogs as follows: one covering compressors, pumps, turbine and speed reducers and one on centrifugal pumps. The latter is a handbook on the types and designs as well as uses of centrifugal pumps.

Celite Products Co., 1320 South Hope St., Los Angeles, Calif.—1927-8 Lecture on High Temperature Insulation.

National Electrical Manufacturers Assn., 420 Lexington Ave., New York, N. Y.—NEMA handbook for power switchboard and switching equipment.

Crouse-Hinds Co., Syracuse, N. Y. — Folder No. 46 on "Floodlight Projectors."

Foster-Wheeler Corp., 165 Broadway, New York, N. Y.—New bulletins as follows: Bulletin E. C. 102 covering the Foster Economizer; Bulletin 119, Exhaust Steam Hot Water Heating Systems; Bulletin 120, Extraction Type Feed Water Heaters.

American Gas Association, 420 Lexington Ave., New York, N. Y.—"Steam Boilers," a reference book on the application of gas to steam boilers for industrial purposes.

The Bristol Company, Waterbury, Conn. —Bulletin No. 362, "Bristol Recording Instruments in the Power Plants."

Combustion Engineering Corp., 200 Madison Ave., New York, N. Y.—Bulletin on "Aims and Tendencies in Steam Generation and Combustion Engineering."

Robinson Manufacturing Co., Muncy, Pa.—Bulletin No. 202 — Mailing piece describing "Unique" mixers and conveying and elevating equipment.

International Nickel Co., 67 Wall St., New York, N. Y.—New publications as follows: Bulletin 11, notes on machining alloy steel; instructions for adding nickel to cast iron; use of nickel in cast iron.

Driver-Harris Co., Harrison, N. J.—New folders on alloy bolts for heat resisting purposes and on Nichrome castings.

PATENTS ISSUED
Nov. 8 to Nov. 22, 1927

PAPER, PULP AND SUGAR

Pulp Beater. Laurence Albeus Barry, Bogota, and Laurence Ambrose Barry, Irvington, N. J.—1,647,982.

Method of Treating Sulphate and Soda Pulp. Richard Collins, Three Rivers, Quebec, Canada.—1,648,111.

Composition Paper or Pulp Board and Method of Making the Same. John H. Mitchell, Havana, Cuba.—1,648,237.

Process of Manufacturing Paper. Arthur E. Barnard and Robert G. Caswell, Newton, Mass., assignors to W. B. Pratt, Inc., Newtonville, Mass.—1,648,838.

Method of Producing Sulphite Pulp. James Brookes Beveridge, Richmond, Va.—1,649,942.

Preparing Stuff for Paper Making. Ernst Mahler, Neenah, and Henry A. Rothchild, Appleton, Wis., assignors to Kimberly-Clark Company, Neenah, Wis.—1,650,022.

PETROLEUM REFINING

Recovery of Gasoline. Eugene C. Herthel and Thomas de Colon Tifft, Chicago, Ill., assignors to Sinclair Oil and Gas Company, Tulsa, Okla.—1,648,585.

Process for Continuously Cracking and Fractionating Hydrocarbons. Alexander C. Spencer, Sarnia, Ontario, Canada, assignor to Standard Development Company.—1,648,967.

Process of Refining Lubricating Oils. Oswald C. Brewster, Casper, Wyo., assignor to The Sharples Specialty Company.—1,649,095.

Process of Treating Emulsified Oils. Gustav Egloff and Harry P. Benner, Chicago, Ill., assignors to Universal Oil Products Company, Chicago, Ill.—1,649,102.

Apparatus for Treating Emulsified Oils. Gustav Egloff and Harry P. Benner, Chicago, Ill., assignors to Universal Oil Products Company, Chicago, Ill.—1,649,103.

Process of Treating Hydrocarbon Oils. Gustav Egloff, Chicago, Ill., and Robert T. Pollock, New York, N. Y., assignors to Universal Oil Products Company, Chicago, Ill.—1,649,104.

Apparatus for Cracking Oil. Gustav Egloff and Harry P. Benner, Independence, Kan., assignors to Universal Oil Products Company, Chicago, Ill.—1,649,105.

Retort for Treating Oil Shale. Edward B. Roth, St. Louis, Mo.—1,649,195.

Method of and Apparatus for Making Gasoline. Forrest E. Gilmore, Los Angeles, Calif., assignor by direct and mesne assignments, of one-sixth to Frank Ahlburg, Los Angeles, Calif., and one-sixth to William K. White, San Francisco, Calif.—1,649,345.

Process for Treating Cracked Hydrocarbon Distillation Products. Henry Blumenberg, Jr., Meapa, Nev.—1,649,384.

Distillation of Hydrocarbon Oils. Frank A. Howard, New York, N. Y., assignor to Standard Development Company.—1,649,532.

Process of and Apparatus for Distilling Oil. George W. Wallace, San Francisco, and Harry K. Ihrig, Berkeley, Calif.; said Ihrig assignor to said Wallace.—1,650,169.

Process of Dehydrating Oil. Bud Hildebrand, Long Beach, Calif.—1,650,514.

Art of Cracking Hydrocarbons. Edward W. Isom, Winnetka, Ill., assignor to Sinclair Refining Company, Chicago, Ill.—1,650,519.

ORGANIC PROCESSES

Process for the Preparation of Substituted Guanidines. Emil Kline, Hudson, N. Y., assignor, by mesne assignments, to The Grasselli Chemical Company, Cleveland, Ohio.—1,648,184.

Organic Molding Composition. Sidney Marion Hull, Western Springs, Ill., assignor to Western Electric Company, Incorporated, New York, N. Y.—1,648,179.

Process for the Production of New N-Alkycarbazolphosphinous Acids. Arthur von Weinberg, Frankfort-on-the-Main, and Werner Schmidt, Fechenheim, near Frankfort-on-the-Main, Germany, assignors to I. G. Farbenindustrie Aktiengesellschaft.—1,648,207.

Benzoxazolone Arsonic Compounds. Ludwig Benda, Mainkur, near Frankfort-on-the-Main, Germany, assignor to I. G. Farbenindustrie Aktiengesellschaft.—1,648,214.

Treatment of Oils and Fats for the Neutralization and Removal of Their Fatty Acid Content. Jacob William Spensley, Manchester, England.—1,648,367.

Solvent. Robert C. Luly, St. Louis, Mo.—1,648,314.

Process for the Oxidation of Aldoses. Arthur Stoll, Ariesheim, near Basel, and Walter Kussmaul, Basel, Switzerland, assignors to the Firm Chemical Works formerly Sandoz, Basel, Switzerland.—1,648,368.

Process of Changing the Viscosity Characteristics of Nitrocellulosic Materials. Paul C. Seel, Rochester, N. Y., assignor to Eastman Kodak Company, Rochester, N. Y.—1,648,509.

Process of Preparing Halogen Substituted Anhydrides of the Fatty Acids. Hans T. Clarke and Carl J. Malm, Rochester, N. Y., assignors to Eastman Kodak Company, Rochester, N. Y.—1,648,540.

Process for Production of Formaldehyde. William C. Arsem, Schenectady, N. Y., assignor to Commercial Solvents Corporation, Terre Haute, Ind.—1,648,602.

Apparatus for Use in the Manufacture of Artificial Silk and the Like. Donald A. McKenzie, Swarthmore, Pa., assignor to The Viscose Company, Marcus Hook, Pa.—1,648,619.

Manufacture of Oxidation Products of Acenaphthene. Harry F. Lewis, Buffalo, N. Y., assignor to National Aniline & Chemical Company, Inc., New York, N. Y.—1,649,833.

Process of Making 2,3-Hydroxynaphthoic Acid. William S. Calcott, Penns Grove, N. J.; Arthur R. Hitch, Wilmington, Del.; and Hermann W. Mahr, Penns Grove, N. J., assignors to E. I. du Pont de Nemours & Company, Wilmington, Del.—1,648,839.

Synthetic Resinous Product and Process of Making Same. Boris N. Lougovoy, Montclair, N. J., assignor to Ellis-Foster Company, Montclair, N. J.—1,648,852.

Method and Apparatus for Carbonization of Subdivided Fuel. Samuel McEwen, London, England, assignor to International Combustion Engineering Corporation, New York, N. Y.—1,648,856.

INORGANIC PROCESSES

Process for the Concentration by Evaporation of Phosphoric Acid. Eldon L. Larison, Anaconda, Mont., assignor to Anaconda Copper Mining Company, Anaconda, Mont.—1,648,137.

Production of Barium Silicofluoride. Howard S. McQuaid, Cleveland, Ohio, assignor to The Grasselli Chemical Company, Cleveland, Ohio.—1,648,143.

Process of Purifying Phosphoric Acid. Ernest F. Pevere and George A. Hendrie, Niagara Falls, N. Y., assignors to Phosphorus Hydrogen Company, New York, N. Y.—1,648,146.

Process for the Production of Stable, Sterilizable, Complex Auro-Sodium-Thiosulphate Solutions. Ludwig Benda, Mainkur, near Frankfort-on-the-Main, Germany, assignor to I. G. Farbenindustrie Aktiengesellschaft.—1,648,213.

Process for Recovery of Sodium Thiocyanate. Ralph E. Hall, Pittsburgh, Pa., assignor to The Koppers Company, Pittsburgh, Pa.—1,648,224.

Arsenical Product and Process of Making Same. John F. Blyth, Newark, and Carleton Ellis, Montclair, N. J.—1,649,562.

Process for the Manufacture of Pure Zirconium Sulphate. Hans Trapp, Oranienburg-Berlin, Germany.—1,648,569.

Manufacture of Disodium Phosphate. Herbert H. Meyers, Pittsburgh, Pa., assignor to Armour Fertilizer Works, Chicago, Ill.—1,648,656.

Process for Manufacturing Barium Sulphide. Gordon Richardson, New York, N. Y., assignor of one-fourth to Phanor J. Eder, Forest Hills, N. Y.—1,648,870.

Oxidizing Metallic Solutions. Louis F. Clark, Potrerillos, Chile.—1,649,152.

Process of Producing Aluminum Chloride. Henry Blumenberg, Jr., Moapa, Nev.—1,649,383.

Process for Obtaining Liquid Sulphurous Acid from the Products of Combustion of Sulphur or Sulphurous Pyrites. Paul Jodeck Berlin, Germany, assignor to Allgemeine Gesellschaft für Chemische Industrie m. b. H., Berlin-Schoneberg.—1,649,701.

CHEMICAL ENGINEERING EQUIPMENT AND PROCESSES

Apparatus for Purifying and Solidifying Aluminum Chloride. Clifford W. Humphrey, Red Bank, N. J., and Donald S. McKittrick, Oakland, Calif., assignors to said Humphrey and Henry I. Lea, Santa Monica, Calif.—1,645,144.

Process of Making Table Salt. Frederick W. Huber, Riverside, Calif.—1,645,238.

Water-Carbonating Apparatus. William C. De Armond and William Ray H. Watt, Philadelphia, Pa.—1,645,320.

Chromium Plating. Harrie C. Pierce, Indianapolis, Ind., assignor to Metals Protection Corporation, Indianapolis, Ind.—1,645,927.

Process of Revivifying Fire-Extinguishing Solutions. Clifford B. White, Utica, N. Y., assignor to Foamite-Childs Corporation, Utica, N. Y.—1,646,046.

Water Softener. Charles P. Eisenhauer, Dayton, Ohio, assignor to The Duro Company, Dayton, Ohio.—1,646,581.

Aluminum-Chloride Process. Henry I. Lea, Santa Monica, Calif., and Clifford W. Humphrey, Red Bank, N. J.—1,646,732.

Aluminum-Chloride Process. Henry I. Lea, Santa Monica, Calif., and Clifford W. Humphrey, Red Bank, N. J.—1,646,733.

Method of Treating Sulphur. James W. Schwab, Gulf, Tex., assignor to Texas Gulf Sulphur Company, Bay City, Tex.—1,646,838.

Means for Roasting Metallic Ores. Henry Squarebrigs Mackay, London, England.—1,647,050.

Erosive Resistant Ferrous Alloy. Charles B. Jacobs, Wilmington, Del., assignor to E. I. du Pont de Nemours & Company, Wilmington, Del.—1,647,096.

Process for Recovering Lead Chloride. Wilhelm Witter, Halle-on-the-Saale, and Paul Nehring, Brunswick, Germany.—1,647,426.

Process for Collecting and Utilizing Aluminum Chloride. Edson R. Wolcott, Los Angeles, Calif., assignor, by mesne assignments, to The Texas Company, New York, N. Y.—1,647,446.

Apparatus for Fabricating Agglomerated Masses. Richard Bowen, Columbus, Ohio, assignor to Super Coal Process Company, Augusta, Me.—1,646,385.

Mixing Device. Richard Bowen, Columbus, Ohio, assignor to Super Coal Process Company, August, Me.—1,646,386.

Method and Apparatus for Separating Matter of Different Specific Gravities. Hugo Velten, Halberstadt, Germany.—1,646,506.

Absorption Refrigerating Apparatus. Gaudenz Bäyer, Ausburg, Germany.—1,646,520.

Drum Mill. Paul Goebels, Dessau, Germany—1,646,532.

Temperature Control Valve. Robert Maclaren, Culross, Fife, Scotland.—1,646,548.

Process of Preparing a Medium for the Treatment of Water. Herman Reinbold, Omaha, Neb.—1,646,596.

Art of Fractional Distillation. Nathaniel E. Loomis, Elizabeth, N. J., and Warren K. Lewis, Newton, Mass., assignors to Standard Development Company.—1,646,619.

Cake-Washing Means for Rotary Vacuum Filters. Wilhelm Mauss, Durban Natal, South Africa.—1,646,653.

Fractional Distillation Process and Apparatus. Heinrich Koppers, Essen-Ruhr, Germany, assignor to The Koppers Development Corporation.—1,646,698.

Pulverizing Apparatus. L. V. Andrews, Worcester, Mass., assignor to Riley Stoker Corporation, Worcester, Mass.—1,646,720.

Electrochemical Means for Preventing Corrosion. Ronald Van Auken Mills, Sandy Spring, Md., assignor to Peter Q. Nyce, Washington, D. C.—1,646,735.

Electrochemical Means for Preventing Corrosion. Ronald Van Auken Mills, Sandy Spring, Md., assignor to Peter Q. Nyce, Washington, D. C.—1,646,736.

Pulverizer. Harry Arthur Kimber, New Rochelle, N. Y.—1,646,752.

Apparatus for Mixing Fluids of Different Densities. Fred Jost, San Francisco, Calif.—1,646,913.

Weighing Moving Material. Martin Castricum, Springfield, Mass., assignor to The Fisk Rubber Company, Chicopee Falls, Mass.—1,646,950.

Time-Controlled Regulating Apparatus. Harry Y. Norwood, Rochester, N. Y., assignor to Taylor Instrument Companies, Rochester, N. Y.—1,646,976.

Process of Fabricating Agglomerated Masses. Richard Bowen, Columbus, Ohio, assignor to Super Coal Process Company, Augusta, Me.—1,647,075.

News of the Industry

Chemical Manufacturers Hold Annual Meeting

THE ANNUAL Meeting of the Synthetic Organic Chemical Manufacturers Association was held on Friday, December 9, at the Hotel Commodore, New York City. The executive meeting of the association was held in the morning, at which officers were elected for the coming year.

At the luncheon the following speakers were heard: John E. Edgerton, president of the National Association of Manufacturers, and president of the Lebanon Woolen Mills, Lebanon, Tenn.; Dr. Charles H. Herty, advisor to the Chemical Foundation, New York City; Daniel F. Waters, president of the Germantown Dye Works, Germantown, Pa.; Dr. Arthur L. Faubel, secretary of the American Tariff League, New York City.

Mr. Edgerton spoke on the relation of the American manufacturer to the tariff question. The one thing that American brains and energy have accomplished is the industrial structure of the country, which was done with the help of the protective tariff, the open shop and the guarantee of equal rights to all men.

Dr. Herty and Mr. Waters, the two honorary members of the association who were present, brought greetings to the association.

Dr. Faubel spoke of the indifference of the American manufacturer to the tariff, and the need of educating the general public to the necessity of continuing the protection afforded by the tariff. At the present time, many groups are actively working for a lowered tariff, and Dr. Faubel warned that in another year there would be a serious attempt to change the tariff schedule.

Officers elected for the ensuing year were: President—August Merz; treasurer—F. P. Summers; vice-presidents—Ralph E. Dorland, W. F. Harrington, E. H. Killheffer, P. Samuel Rigney.

Board of governors: E. A. Barnett, John Campbell & Co.; A. S. Burdick, Abbott Laboratories; Ralph E. Dorland, Dow Chemical Co.; A. J. Farmer, Pharm-Chemical Corp., W. F. Harrington, E. I. duPont deNemours & Co.; E. H. Killheffer, Newport Chemical Works; E. H. Klipstein, E. C. Klipstein & Co.; August Merz, Heller & Merz Co.; A. Cressy Morrison, Carbide & Carbon Chemicals Corp.; A. V. H. Mory, Bakelite Corp.; P. Samuel Higney, Roessler & Hasslacher Chemical Co.; F. P. Summers, Noil Chemical & Color Works; Wm. S. Weeks, Calco Chemical Co.; S. W. Wilder, Merrimac Chemical Co.; F. G. Zinsser, Zinsser & Co.

Steam Still Devised for Naval Stores Industry

THE OLD-TYPE fire still, on which producers of naval stores have relied for many years for separating turpentine and rosin, can now be improved by converting it into a steam still, according to the United States Department of Agriculture.

The new still is an outgrowth of the work of the Naval Stores Unit of the Bureau of Chemistry and Soils, under the direction of Dr. F. P. Veitch and was designed recently by J. O. Reed, Associate Engineer. Although the improvement had been in contemplation for some time an opportunity to try it out came only when one of the progressive naval stores producers of Mississippi appealed to the Bureau for assistance in improving his still practice and in producing uniformly higher grades of rosin than was possible with the fire still. The department has made application for a patent covering the new still which will be dedicated to the public.

The first practical adaptation of the new still was made early in the spring. So successful was its operation that another was constructed within a month. Several other large companies are also contemplating converting their old fire stills into steam stills.

Tariff Hearing on Tartaric Acid Delayed

Apparently several months will elapse before there will be any change in the tariff situation pertaining to tartaric acid and cream of tartar. Because of the differences with France applications dealing with French commodities are being held in abeyance. While this affects cream of tartar, it does not apply to tartaric acid. It has been suggested to the Commission that the hearing on tartaric acid be held separately, but as the two commodities are covered in the same report it seems probable that the Commission will not authorize action on one without the other.

Commerce Chemical Advisory Committee Enlarged

FOR A number of reasons it has been found desirable to increase the membership of the Chemical Advisory Committee to the Department of Commerce, and upon invitation by Mr. Hoover the following persons have accepted appointment to this committee: Frank A. Blair, The Centaur Co., New York; Gilbert Colgate, Colgate & Company, Jersey City, N. J.; Lammot du Pont, E. I. du Pont de Nemours & Co., Wilmington, Del.; Chas. L. Huisking, Chas. L. Huisking, Inc., New York; H. C. Parmelee, McGraw-Hill Publishing Co., New York; Frederick Rosengarten, Merck & Co., Philadelphia; J. T. Skelly, Hercules Powder Co., Wilmington, Del.; Walter Teagle, Standard Oil Co. of New Jersey, New York.

In addition, the committee as constituted three years ago is composed of the following men: A. Cressy Morrison, Chairman, Union Carbide & Carbon Corp., New York; H. E. Howe, Secretary, Industrial & Engineering Chemistry, Washington, D. C.; Leo H. Baekeland, Bakelite Corporation, New York; Dr. A. S. Burdick, Abbott Laboratories, Chicago, Ill.; Henry Howard, Grasselli Chemical Co., Cleveland, Ohio; Gustavus Ober, G. Ober & Sons Co., Baltimore, Md.; E. T. Trigg, John Lucas & Co., Philadelphia, Pa.; S. W. Wilder, Merrimac Chemical Co., Boston, Mass.

Tanners Council Announces Additional Gift

THE Foundation of the Tanners' Council Laboratory at the University of Cincinnati announces receipt of a gift of $15,000 from George W. Olmsted of the J. G. Curtis Leather Co., Ludlow, Pa. This is added to the fund of $40,000 previously announced that is the nucleus for the development of a fund of a million dollars.

In addition to the gift of Mr. Olmsted contributions have been made by Mrs. Louis Mayer of Orange, N. J., in memory of her husband, formerly President of R. Neumann & Co., Hoboken, N. J.; by George H. Raymond, Chairman of the Board of Directors of Hans Rees' Sons, Inc., New York; and by the Tanners Products Co. of Chicago, Ill., known as the Fred Vogel, Jr., Testimonial Fund.

Weidlein Elected President of A. I. C. E.

A FOUR DAY program of technical sessions, plant visits and social functions, admirably planned and handled by the local committee, was enjoyed by nearly 200 members of the American Institute of Chemical Engineers in St. Louis, Mo., for their twentieth semi-annual meeting Dec. 5 to 8. Headquarters were maintained at the Hotel Chase where the technical sessions and most of the entertainment centered. Officers elected for the coming year are as follows: E. R. Weidlein, president; A. H. White, vice president; H. C. Parmelee, secretary; M. H. Ittner, treasurer; David Wesson, auditor; J. V. N. Dorr, J. R. Withrow, W. C. Geer and R. T. Haslam, directors.

The technical sessions were featured by three symposia, all timely and appropriate to the St. Louis district. Natural gas gasoline was the topic for the first day, papers being read by George Granger Brown, Stewart P. Coleman, J. H. James and Gustav Egloff. At the luncheon served in the Chase ball-room, Jules Bebie, chairman of the St. Louis committee, extended formal welcome to the Institute and guests. The afternoon was devoted to plant excursions, motor buses having been provided to convey the party to Alton, Ill., where the Federal plant of the American Smelting and Refining Company was inspected. The plant of the Hoyt Metal Company at Granite City, Ill., was also inspected on this trip. This plant produces babbit metal, solder, lead pipe, brittania metal, sheet chemical lead, antimonial lead and numerous special alloys. The extrusion of lead pipe traps and the rolling of large sheets were interesting features. A smoker in the evening provided relaxation, enlivened by entertainment and refreshments.

THE second day, Dec. 6, was devoted to a joint session with the American Refractories Institute, the keynote being better co-operation between the chemical engineers, as consumers, and the producers of refractories. Both groups attended the luncheon at which George C. Smith, Director of the Industrial Club of St. Louis, told of the scientific methods which have superseded the usual "booster" methods in St. Louis, to guide the industrial development of the city along sound economic lines. A dinner dance in the evening was largely attended by members and guests.

An all day bus excursion to the lead mines and mills in southeast Missouri occupied Wednesday. As guests of the National Lead Company, the St. Joseph Lead Company and the Desloge Consolidated Lead Company, the visitors were conducted through the mines, shown the crushing, grinding, sizing, screening, classification, and gravity and flotation treatments of the ore, and served a delicious turkey dinner by the ladies of Flat River.

The twentieth anniversary banquet was held in the Chase Hotel Dec. 7. J. C. Vaile, of Philadelphia, as toastmaster, introduced L. F. Nickell who responded to the subject. "A Retrospect." F. W. Willard advanced some interesting thoughts on the effect of the engineer's efforts on human relations on his responsibilities to the body politic. W. J. Gephart, of the First National Bank of St. Louis, spoke of the banker's dependence on the chemical engineer for advice concerning modern industries.

Lead was the topic of the final symposium, papers being presented by George O. Hiers, J. R. Sheppard, O. W. Ellis and A. E. Marshall. R. S. Tour read a paper on synthetic ammonia costs in America and H. L. Olin discussed the adsorptive properties of filter aids. Boarding the chartered buses again, the members were taken to East St. Louis, where, as guests of the East St. Louis Light and Power Company they were served with luncheon and conducted through the mammoth "Cahokia" power plant, an ultra-modern installation generating about 300,000 kw., using pulverized Illinois coal, and built on the isolated phase plan. The Laclede-Christy Clay Product Company's plant was also visited, where 50,000,000 fire brick and 45,000 tons of special hand molded tile are produced annually.

AT THE business sessions, reports were presented by the officers and various active committees. J. V. N. Dorr announced detailed plans for the joint meeting with the British Institution of Chemical Engineers which will cover a two-week period, beginning Aug. 18, when the English visitors will arrive in Quebec, and will involve a trip through the gold, silver and copper districts of the Dominion, three days' session at Niagara Falls followed by visits to Akron, Pittsburgh, Wilmington, Baltimore and Washington. The winter meeting in December 1928 will be curtailed to one day and will be held in New York City.

Textile Chemists and Colorists Hold Annual Meeting

APPROXIMATELY 250 members of the American Association of Textile Chemists and Colorists attended the seventh annual meeting of that organization, which took place in New York, Dec. 2-3, at the Hotel Pennsylvania.

At the first general session of the Association, the necessity for thorough training and preparation for chemists and colorists was particularly stressed, together with a plea for more general and concerted fundamental research in the field, and for basic and constructive thinking.

During two sessions held the second day, papers were presented covering several phases of the contacts between chemistry and the textile industries in dyeing and processing of fibers and fabrics. Considerable emphasis was placed on the newly developed technique in the handling and processing of rayon. A dinner presided over by P. J. Wood brought the convention to a close.

Power Show Holds Interest for Chemical Engineers

THE SIXTH National Exposition of Power and Mechanical Engineering which was held in the Grand Central Palace, New York, Dec. 5 to 10, came as the culmination of what is perhaps the most prosperous and productive year which the industries represented have enjoyed. Coming as it did, coincident with the annual meetings of the American Associations of Mechanical and Refrigerating Engineers, the Exposition was particularly valuable, not only as it established contact between vendors and manufacturers on the one hand, and engineers and buyers on the other, but because of the emphasis which was placed on the educational and instructional features.

With more than 500 exhibitors represented, four times the coverage at the first "Power Show" in 1922, those fields which are allied to the ones strictly concerned with the generation, distribution and application of power, were also well represented. Heating, ventilating, air conditioning and refrigerating equipment filled the booths of more than 200 exhibitors, while a considerable portion of the space was given over to the display of instruments for the control of temperatures, pressures, volume and time functions. A large number of the manufacturers of small tools, machine tools and shop equipment rounded out the list of connected lines.

In the way of new developments, the outstanding feature of the show was the tendency toward greater economy through the application of high pressures, together with the reduction of labor by means of increased use of automatic control and mechanical contrivances. Improvements consisted in the standardization of parts and the simplification and perfection of existing equipment.

Conservation Committee for Oil Industry

AN ASSISTANT Secretary of the Interior, an Assistant Secretary of Commerce, and a Federal Trade Commissioner have been selected as the government's three representatives on the Committee of Nine to consider petroleum conservation legislation, the Federal Oil Conservation Board announced on December 7.

The government representatives are Edward C. Finney, Assistant Secretary of the Interior. Walter F. Brown, Assistant Secretary of Commerce. Abram F. Myers, Federal Trade Commissioner.

Representatives of the petroleum industry, previously announced, are: Thomas A. O'Donnell, California Petroleum Company, Los Angeles, Calif. J. Edgar Pew, Sun Oil Company, Dallas, Tex. W. S. Farish, Humble Oil and Refining Company, Houston, Tex.

Representatives of the American Bar Association will be announced on December 10, at Washington.

NEWS FROM WASHINGTON

By Paul Wooton
Washington Correspondent of Chem. & Met.

PRESIDENT COOLIDGE'S decision that the "development of other methods so that nitrates can probably be produced at less cost than by the use of hydro-electric power" and "that the nitrate plants on this project are of little value for national defense" is taken to indicate that the administration is in complete accord with the Muscle Shoals policy advocated by the Secretary of Agriculture and by the technical staff of the Fixed Nitrogen Research Laboratory. While the last sentence of the President's reference to Muscle Shoals, which evidently was an after-thought inserted after the original paragraph was written, leads to some confusion, the general assumption is that the administration will use the full weight of its influence to dispose of the Muscle Shoals question at this session of Congress, with the understanding that the power will be sold to the highest bidder and the money derived from its sale will be devoted to the stimulation of the use of concentrated fertilizer and experiments, with a view to reductions in its cost.

The President was influenced to make this change in his Muscle Shoals policy, it is believed, by the fact that there are now in the United States six efficiently operated atmospheric nitrogen plants having an output of 35,000 tons per year of fixed nitrogen. By February 1 the production of these plants is expected to have been increased so that the annual rate of production will be 40,000 tons which was the production contemplated when nitrate plant No. 2 at Muscle Shoals was built. With the completion of the Hopewell plant by January, 1930, the annual production during that year is expected to be at least 130,000 tons.

Another feature of the situation which is thought to have influenced the President is the fact that the existing plants are in different ownerships and are well located should a national emergency arise.

IN addition to the 35,000 tons now being produced by synthetic processes, the production of by-product ammonia has mounted until last year it reached a total of 142,000 tons, which is a decided increase from the 58,000 tons produced in 1917. Thus the atmospheric nitrogen production at present is several times greater than the contemplated output at Muscle Shoals and the need for making production a condition of the Muscle Shoals contract no longer exists, the President seems to have concluded.

As this is written, Senator Norris has not actually reintroduced his resolution setting forth his proposal for the distribution of the plants. He has announced, however, that he will reintroduce the resolution with only one major change. Under that resolution the government would operate the power plants and sell the power, giving preference to municipalities. He also proposes, however, that transmission lines may be constructed as the Secretary of War may deem advisable so as to insure competitive bids for the power. The money secured from the sale of the power is to be used in the construction of experimental fertilizer plants at Muscle Shoals or elsewhere.

INFORMATION received by the Department of Commerce from the office of its Commercial Attaché at Paris confirms that the Dye Stuffs Agreement between the French and the Germans signed at Frankfort recently included the British as well. This agreement also has been approved by the Boards of the French and German Companies and is awaiting only British government sanction, which is expected shortly. The Entente is expected to be formally effective January 1. Swiss Dye Stuffs producers are negotiating for entry into this Entente.

The terms relative to the division of the export markets among the three signatory countries is based upon their 1926 total dyestuffs exports, as follows: France—12 per cent; Germany—75 per cent; Great Britain—13 per cent. Each country reserves its home markets except that each agrees to purchase from other members those dyestuffs not made nationally. The French quota is to be allocated as follows: Kuhlmann — 60 per cent; Société Anonyme des Matières Colorantes, St. Denis — 30 per cent; Compagnie Francaise des Produits Chemiques, St. Clair du Rhône—10 per cent. France and Germany agree to exchange process information. Colonies and Protectorates are considered export markets.

Negotiations relative to the formation of a Synthetic Nitrogen Entente between France, Great Britain and Germany are said to be progressing favorably. The primary aim is a common sales program against Chilean nitrates. Some consider that American participation is necessary to insure the success of the undertaking but others think the co-operation of either American producers or sellers will suffice.

While the chemical industry is being given credit for a desire to secure certain unnamed amendments to the anti-trust statutes, no request to this effect, so far as can be learned, has been received by the government agencies dealing with corporate or industrial matters, or by members of Congress who are particularly interested in the building up of a domestic chemical industry. The feeling in these quarters is that the chemical industry, particularly, would have little to gain by any change in the existing laws covering this phase of business activity.

For instance, friends of the industry here point out, that the anti-trust statutes afford protection to the chemical industry that is more valuable than any change that might be made in an effort to make it easier to compete in world markets. A spirit of individualism has characterized the growth of this industry. The smaller producer has been a great factor in making it a basic industry which serves such a diversity of activities.

One of the important factors in the growth of the chemical industry has been the public confidence it has enjoyed. There has been strong public support for adequate tariff protection for the industry and the isolated attacks which have been made upon it have fallen flat. Government specialists, and others in Washington in close touch with the industry, recent published statements to the effect that industry is seeking to amend the anti-trust laws, as they are sure that there is no such movement on foot, and because they tend to put the industry in a bad light with the public. The industry apparently is anxious for its large units to grow and for its independent companies to multiply and grow likewise.

The German I. G. has not been so conspicuously successful that the industry here is impressed with the alleged advantages of a chemical monopoly. A number of chemical interests have taken advantage of the existing Webb-Pomerene law and it is believed there will be an increasing tendency for other chemical concerns to use that means which is offered to compete more successfully with large aggregations of capital engaged in chemical activities abroad.

THERE is nothing in the extension of European cartels which calls for any change in the anti-trust laws, it is believed in administration circles. The main purpose of cartels is to increase prices so that the effect is to reduce the pressure of competition which American interests meet in world markets. If they hold together long enough they may get into mass production, in which case it is admitted they would become more formidable competition.

British restrictions on the production of rubber are stimulating its growth elsewhere at a rapidly accelerating rate. When restriction began five years ago the British dominated the situation by a large margin. Next year more than fifty per cent of the world's rubber will be produced outside the British colonies.

In like fashion Cuba, as a result of a restriction program, bids fair to do more to stimulate the domestic sugar industry than any practical measures which the United States could adopt.

Amalgamations Serve to Rationalize British Industries

International Chemical Cartel Based on Interchange of Technical Information and Patents

From our London Correspondent

THE chemical industry of this country, which has been accused of being conservative, may claim to have been a pioneer in the policy of amalgamation which is now rapidly gathering momentum in other industries. One example is the amalgamation of the two great armament firms of Vickers and Armstrong-Whitworth, the details of which are just announced and which has come about shortly after the reconstruction and writing down of the capital of Vickers Limited. The combined share capital will in the first instance, be about $100,000,000 and after paying for preference and other priority stocks and dividends, it is estimated that the annual profit will not be less than $5,000,000. A remarkable feature of the proposals put forward is the arrangement made with an insurance office to secure a guaranteed minimum profit for the merger company. Profits in excess of $5,000,000 per annum will, up to $1,000,000 in each year, be payable to the insurance company, 40 per cent of the excess profits being appropriated for this purpose. This indicates confidence in the ability to earn such dividends, equivalent to about 4½ per cent of the capital, and it is expected that these will be largely forthcoming from the economies which are foreshadowed by joint management and production. Whether a profit-sharing and welfare scheme such as was outlined by Imperial Chemical Industries will also form a part of the future policy of this merger remains to be seen, but there can be no doubt that this process of rationalization of British industry has come to stay.

SUCH rationalization of British industries appears to have aroused considerable and unfavorable criticism in the United States, because there is in addition, a tendency to consider the formation of international cartels and agreements which are regarded as being inimical to American intreests. It may, therefore, not be out of place to remind the American chemical industry that the formation of economic groups of reasonable size has proceeded in the United States for many years and that this country has lagged behind in the process. The recent rumors in regard to international understandings in the basic chemical industries must not be taken too seriously. They are probably directed more toward interchange of technical information, and possibly to a certain limitation of markets based upon the patent position as disclosed in regard to certain processes. That there should be any wholesale fixing of prices, actual amalgamation or the establishment of unity of interest, directed against the United States is regarded as being practically out of the question. The leading organizations are so closely linked up in all the leading European countries with corresponding interests in the United States, that in any case, the present tendency for a better understanding and the limitation of wasteful competition and litigation can only be to the ultimate benefit of the American chemical industry.

So far these chemical mergers in Europe have operated, if anything, to reduce prices and to improve quality and provided their size and scope do not become unwieldy, this tendency is likely to be maintained.

AMONG recent rumors, considerable attention has been drawn to the alleged discovery of improvements in the manufacture of synthetic rubber by the German I. G. It is well-known that at Leverkusen, an experimental factory was erected and operated intermittently. Certain improvements and economies in the manufacture of isoprene and butadiene have been made recently but rumors in regard to manufacture of synthetic rubber from these products are about as frequent as the appearance of the traditional sea-serpent and there is no reason for thinking that at the present low price for rubber, there is any likelihood of a satisfactory synthetic product being economically possible. There is, however, in course of being tried out in this country, an artificial product with properties very similar to those of rubber and which can be made cheaply enough to warrant its practical trial as a road-making surface.

In the rayon field the possibilities of British Celanese are now to be regarded more in their true perspective and as a leading daily paper put it, their product is probably better than their finance. The Nuera Company has decided upon an increase in capital and has concluded a favorable agreement with Messrs. Courtaulds Limited for an interchange of technical information and for a division of commercial production under the Lilienfeld patents, by which it is claimed that a product of great strength when wet can be produced. This rayon is also said to be capable of being made in exceptionally fine deniers, and both of this company and in regard to the Non-inflammable Film Company, further interesting announcements may be expected in the near future. Other rayon companies are operating with varying success, but in most cases there has been a radical alteration from the program which was outlined when these companies were formed, and in some cases, not only processes but the machinery which it was contemplated would be installed, have been considerably altered or abandoned. The Apex Company, being the only company other than British Celanese formed for the manufacture of acetate silk, is likely to commence operations shortly, and the appearance of its products is awaited with interest.

THE coal industry is still in the doldrums and the day which was set aside in Parliament for debating the grievances of the industry was wasted owing to the obstructive tactics of the Labor members of Parliament. This also rendered abortive the attempt that was made by Low Temperature Carbonization Limited to introduce into that debate some reference to the importance of low temperature carbonization as regards the successful future of our coal supplies. This took the form of a letter sent to all members of Parliament, drawing attention to the features of low temperature carbonization and the advantages of the company's smokeless fuel "Coalite." in particular. It contained the interesting announcement that the works of the company at Barnsley were now treating continuously about 1,500 tons per week of coal and that as a result of the satisfactory results obtained, "a colliery," after a test on 150 tons of their coal, had decided to erect a plant for the treatment of 500 tons per day of coal in accordance with the "Coalite" process. The view held in competent quarters at present is that while low temperature carbonization will find its proper level in the general scheme of things, it must not be overlooked that there is only a limited market for domestic fuel and that the importance of any changes directed toward the universal adoption of low carbonization, as a solution of our oil problems, or of the alleged difficulty of utilizing our coal fines or smalls, is exaggerated. It is felt that a modified Bergius process, such as that which has been adopted by the German I. G. for their lignite resources is more likely ultimately to be introduced for the production of oil with a view to reducing imports and that the domestic demand for fuel will then be met by the briqueting of semi-coke with a smokeless binder.

Special Report No. 1 of the Chemistry Research Board of the Department of Scientific and Industrial Research relates to investigations carried on at the Naval Cordite factory at Holton Heath, and represents an attempt to discover means of making formaldehyde cheaply by the oxidation of methanol.

The report shows that the attempt was not successful, but the report is interesting and as the possible forerunner of reports of a similar character, represents a definite departure from the usual official policy. In view of the tendency for nearly all countries to manufacture methanol synthetically, the results obtained may stimulate work in other directions, and the report also includes results obtained in regard to concentration of dilute formaldehyde solution as well as in regard to the action of metals on formaldehyde.

Chemical Congress Awards Berthelot Medal to Claude

Recent Meeting in France Also Developed Suggestions for Advancing the Industry

From our Paris Correspondent

MANY chemists who had come to Paris in order to take part in the celebration of the Marcelin Berthelot centenary attended the Seventh Congress of Chemical Industry. The congress awarded its medal in honor of Berthelot to George Claude.

About two hundred papers were read during the congress. In the analytic section the congress moved a resolution stating that the study of analytic methods should be put on an international basis the object being less the unifying of the present methods than their codification. It was also asked that a permanent committee including a majority of technical experts be elected, this committee being constantly informed of the wants and needs of the users of analytic methods.

In the equipment section a resolution was moved asking the creation of a scientific laboratory studying ultra-pressures to enable methodical investigations of this new field of research.

In this connection it is worthy of note that according to a recent memoir read in the National Academy of Sciences, James Besset has built an apparatus where pressures of over 20,000 atmospheres can be realized. This apparatus, the result of long research and numerous experiments, may be handled without danger; its use will allow investigations in scientific branches, particularly in crystallography, in the research of allotropy in chemical products and to detect the reactions of substances to ultra-pressures. Mr. Besset's aim in building this apparatus was the study of allotropy in carbon in order to realize synthetic diamonds.

The equipment committee also asked that common measures be adopted for vessels containing compressed combustible gasses, also that common types of valves and test-pressures be adopted. The committee moreover suggested that a central bureau be established and that international scientific and technical documents on liquid combustibles should be published in French, English, German and Spanish.

In order to increase the number of papers on rubber, tanning and similar industries the Congress discussed the question of making an adequate reward for the best paper issued.

IT IS particularly interesting to note from a national point of view that one of the Congress' motions concerns the new patent bill discussed by the French Senate. The congress hopes that in a near future the patent on products will be cancelled, that is, the patent on products originated by the patent law of 1844 and which the Chamber of Deputies has recently not only prolonged but gave additional power.

It is no exaggeration to say that the patent on products has been one of the prevailing causes of the stagnation in the Franch organic chemical industry. Prospects would surely be more hopeful if the German patent formula (patent on processes) was adopted in France at least in the chemical industry. This concerns ont only the French manufacturers but all foreign manufacturers who are required to take patents in France. With the present French legislation no one has the right to manufacture a new product protected by a patent during the duration of the patent even if the product is obtained by entirely new and more practical methods. And this disadvantage is strengthened by the fact that the new bill voted by the Lower Chamber lengthens the duration of the patents from 15 to 20 years.

The business section of the Seventh Congress of Chemistry dscussed the centralizing of the big chemical industries and the international agreements now under way.

The United States' representatives in the congress were T. Bogert of Columbia University and Messrs. A. Townbridge, Weidlein, Reese and Seidell.

SUBSCRIPTIONS for "Chemistry House"—the Berthelot memorial—amounted to about fifteen million francs, half of which was subscribed by the French. The first stone was laid on October 26. During the following days meetings were held and the opportunity of an International Information Office for chemistry was discussed and approved. This office would centralize in Paris all scientific and technical information in order to give its subscribers all statistical or bibliographical information wanted. The representatives of forty nations decided to support this International Office but their pledge is so far merely a *pro forma* one and does not really bind anybody. However as soon as seven governments will have ratified their representatives' vote the office will become a reality and the permanent committee will be summoned to elect a director. The seat of the international office will be in Paris and the signature record will remain open six months.

Great Britain's and the United States' representatives have not joined the other nations in this occurrence and their withdrawal has been variously commented upon. We fear that the international office promoters did not have in view merely scientific and information purposes. Many French people are aware of this and regret this double abstention and the grounds that caused them, knowing only too well that the projected office will be a mere duplicate of scientific institutions.

The "Information Nickel Office" whose president is Leon Guillet, member of the French Academy of Sciences, has organized a "Nickel Week" at the Paris "Conservatoire des Arts et Métiers." The office's object, which has been created in imitation of the Copper and Brass Research Association founded by the American Zinc Institute, is the greater use of nickel in France.

Now we hear that this communication presented like an original paper concerns in fact a process wall known in the iron industry as the "Parkerization." We are really surprised to see an eminent scholar like Mr. Guillet making use of his official situation in the Academy for the booming of new commercial specialty.

The French "Borvisk" whose works at Nevers produce rayon by the viscose process, has met with such difficulties that complementary help was necessary to prevent its closing down; 50 million francs were subscribed by the following firms to refloat the company: Kuhlmann, Agache & Son, Ltd., and Dollfus, Mieg & Co.

According to most accurate rumors a European trust of the chemical industry is being contemplated. This trust would group together the French, British and German manufacturers of chemical products, coloring matters and fertilizers. So far it is impossible to get official confirmation of the secret conferences held between the French representatives of the "Comité Central de l'Industrie Chimique" and the German representatives of the I. G. Farben-Industrie.

A temporary custom convention has just been signed between France and the United States. The "Journal Officiel" of November 16 publishes the new tariff. The United States has benefited by the minimum tariff for the import in France of many American goods, this minimum tariff being the same as the one granted to Germany. The American chemical trade is therefore placed on almost the same footing as the German chemical trade, the American dyestuffs particularly, as the custom tariff applied to American imports and German imports are almost similar.

Alkali and Chlorine Plant for Pacific Coast

The Tacoma Electrochemical Co., recently formed with a caital of $1,000,000, by officials of the Pennsylvania Salt Co., Philadelphia, Pa., has acquired a large tract of waterfront property within the city limits of Tacoma, Wash., and has authorized plans for a new plant for the production of caustic soda, liquid chlorine and kindred products. The equipment will be very similar to that used by the parent company at its Wyandotte and Menominee plants.

News in Brief

A STATEMENT given out by the office of Senator Copeland of New York announces that the Senator will introduce in the next session of Congress a bill regulating the use and sale of cosmetics containing poisonous or deleterious substances.

THE SUDBURY Basin Company has acquired the Jarvis Island barium sulphate deposits, some 40 miles southwest of Port Arthur, Ontario. There are said to be valuable deposits on its property, and it is the intention of the company to use the material in combustion with zinc for the manufacture of lithopone. The deposits on Jarvis Island have been developed to some extent by the opening up of shafts and drifts.

THE UNITED STATES Public Health Service has notified ship owners that the cyanide method of fumigation will be used henceforth on ships docking at Philadelphia, supplanting the use of sulphur. The change comes about five years after being made at the Port of New York.

I. G. FARBENINDUSTRIE A. G., controlling German production of synthetic methanol, and Holzverkohlungsindustrie A.G., leading in production of wood distillation methanol, have renewed for 1928 their year-to-year contract pooling methanol sales on all markets, except the North American. It fixed prices gauged to meet wood distillation costs of production. The latter thus escapes competition from the cheaper synthetic product.

IN ACCORDANCE with a previous announcement, the American Society of Mechanical Engineers will launch, the first of the year, a new and comprehensive Engineering Index Service which will be mailed to subscribers weekly. The Editor is Joshua E. Hannum, M.E., who has recently been engaged in directing the Safety and Production Study of the American Engineering Council.

AT THE annual meeting of the International Acetylene Association, held at the Stevens Hotel, Chicago, November 16-18, Dana Pierce, President of the Underwriters' Laboratories, Inc., accepted for his organization the Morehead Gold Medal, the association's annual award for exceptionally meritorious service in the production and utilization of calcium carbide and acetylene.

THE FORTY-FIRST collegiate chapter of Alpha Chi Sigma, the national professional chemical fraternity, was installed at the University of Maryland on November 25. Dr. R. M. Burns, of the Bell Telephone Laboratories, national president of the organization, was assisted in the installation by F. C. Vilbrandt, regional supervisor, and by the active members of the fraternity from George Washington University chapter and members of the professional chapter in Washington, D. C. Dr. Burns announced that the membership of the organization includes approximately 7,000 chemists and chemical engineers.

THE NEW CROP of China wood oil is now harvested and initial shipments are en route to Hankow, according to a cable dated November 30 sent to the Bureau of Foreign and Domestic Commerce. It is reported by the trade that this year's crop of wood oil will be good, and that for the fiscal year beginning December 1 not less that 72,000,000 pounds should be available for foreign export from Central China.

Electrification of Sicilian Sulphur Works Delayed

IN A report from Catania, consul I. C. Funk states that great dissatisfaction and disappointment has been expressed by local sulphur interests in that the promised electrification of the sulphur industry is not progressing, and that, in fact, practically no steps at all have been taken to initiate the work. Some years ago the electrical company for Eastern Sicily borrowed money from local interests and to make payment arranged to electrify the entire industry. Ready capital for such an undertaking was lacking, however, and unsuccessful attempts to obtain a loan first in Italy and then in America were made, with the result that very little progress has been made in the much desired electrification of the industry.

Production of sulphur during the first half of 1927 amounted to 108,581 metric tons, as compared with 103,731 tons in the corresponding period of 1926. Shipments increased in the first six months of 1927 to 163,072 tons, resulting in a reduction of stocks on June 30 to 36,199 tons, as compared with 69,438 tons on hand June 30, 1926.

Changes in M.I.T. Chemical Engineering Staff

THE resignation of Professor R. T. Haslam from the chemical engineering faculty of the Massachusetts Institute of Technology has necessitated a number of changes in staff appointments. Professor Haslam left the first of November to join the research staff of the Standard Oil Company of New Jersey, but is retained on the Tech. faculty as a non-resident professor of fuel and gas engineering. Professor Ward, who has been associated with him, will take charge of the fuels research work at the Institute. W. P. Ryan, who has been directing the field station of the Institute at Buffalo, will return to Cambridge to head the School of Chemical Engineering Practice. George Slottman will be acting in charge of the Buffalo station. During the fall term the work at the Bayonne station of the Institute on oil refining will be under the direction of Mr. T. A. Mangelsdorf.

Color Laboratory Studies Industrial Wastes

DISCOVERY of a mold which produces a satisfactory yield of gluconic acid from solutions of glucose may result in the widespread use of gluconic acid in beverages, condiments and the application of dyes, according to the Color and Farm Waste Division, formerly the Color Laboratory, of the U. S. Bureau of Chemistry and Soils. Work on the further development of this process and uses for the product is being actively continued, as is the division's work on the utilization of industrial wastes. Typical of these are paracymene from the paper industry and ortho-dichlorobenzol from the chlorination of benzol. It has been shown that the former has a use as a paint thinner and a base for acid proof resins, while the latter makes an excellent metal polish as well as a starting point for the synthesis of alizarine.

The problem of the utilization of farm wastes is one in which the Color Laboratory has been interested for some time. Following the work which resulted in the development of furfural from a chemical curiosity to a commercial product, an investigation was started into the nature and possible uses of lignin. Attempts to determine its composition have been accompanied by experiments in its utilization in its various forms, and appreciable progress has been made in both directions. Among other things, the lignin found in sulphite waste liquors has been coupled with well known intermediates to produce a series of colors, and its destructive distillation has given eugenol in small quantities. Another investigation undertaken is that into the possible uses of peanut shells. This material contains a good grade of short fibered cellulose, which may find use in the rayon industry, or as a raw material for nitro-cellulose.

Glaubers Salt Production in Canada Increased

A DRYING plant for the dehydration of the natural glaubers salts, of which one of the largest deposits in the world is located at Palo, Saskatchewan, is being planned by the Whiteshore Salts and Chemical Company. Wilbert Fisher and Harry Parsons, president and secretary of the company, were recently in Edmonton, Alberta, on matters relative to financing a dehydration plant and the possibility of securing another outlet for the product in the straw paper industry being promoted there. The utilization of the glaubers salt or sodium sulphate deposits of Saskatchewan is a new venture and already the Palo company has shipped out 3,000 tons of crystals, mostly to the nickel industry of Sudbury, Ontario, and the textile industries of Quebec. Large quantities are being used in the manufacture of sulphate wood pulp. It is expected that the erection of a dehydration plant at a cost of $100,000 and the shipment of the dry salt will broaden the market.

MEN *you should know about*

H. S. PAINE, formerly head of the carbohydrate laboratory of the Bureau of Chemistry, is now chief chemist of the Wilbur-Suchard Chocolate Company, Philadelphia, Pa., recently formed to consolidate H. O. Wilbur & Sons, Inc., and the American interests of the Suchard company, Neuchatel, Switzerland.

J. C. MCLENNAN of the Department of Chemistry, University of Toronto, has been awarded the medal of the Royal Society of England in atomic physics and spectroscopy.

WALTER A. LAYFIELD, vice-president in charge of operations of the Atlas Powder Company, Wilmington, Del., has resigned. He has acted in that capacity since 1913 when the company was organized. For a number of years he was connected with the Repauno Chemical Company, later merged with E. I. duPont deNemours & Company, Wilmington, Del.

J. J. MORSMAN has been elected president of the Carter White Lead Company, Chicago, Ill., succeeding F. M. Carter who was recently elected vice-president of the National Lead Company, New York.

MYRON B. DIGGIN of Matewan, N. J., is the recipient of an industrial fellowship in the Department of Chemistry, Wesleyan University, Middletown, Conn., established by Meech & Stoddard, Inc., Middletown, Conn. He will co-operate with Professor C. R. Hoover, head of the department, in research in gasoline.

VICTOR F. HOUSER has accepted an appointment as ceramic engineer for the Morton Pottery Company, Morton, Ill.

H. E. K. RUPPEL, chief chemist for the Gillette Safety Razor Company, Boston, Mass., has sailed for a trip abroad, accompanying Thomas W. Pelham, vice-president.

WILLIAM DUPONT, formerly president of the Hercules Powder Company, Wilmington, Del., is confined at the University Hospital, Philadelphia, Pa., with a serious illness.

EDWARD J. LAVINO, president of E. J. Lavino & Company, Philadelphia, Pa., recently sailed for a trip abroad, to be absent for a number of weeks.

HAROLD BODIN has become chief of the technical department of the Chicago, Ill., plant of the paint, varnish and lead division of E. I. duPont deNemours & Company, Wilmington, Del.

R. G. MACDONALD, who has been assistant to the sales manager of *Chem. & Met.* since 1925, has been appointed secretary-treasurer of the Technical Association of the Pulp and Paper Industry. He will be located at the headquarters of the Association, 18 East 41st Street, New York City. Mr. Mac-

R. G. MACDONALD

donald is a graduate of M.I.T. and the School of Chemical Engineering Practice. He was formerly employed as a chemical engineer by the Pejepscot Paper Company of Brunswick, Maine, and the Oxford Paper Company of Rumford, Maine.

J. F. WELLER has become chemist in the Rubber Research Laboratory of the Eagle-Picher Lead Co., Joplin, Mo.

R. C. WOODBRIDGE, heretofore director of the Brandywine Laboratory of the Smokeless Powder Division of E. I. duPont deNemours and Co., Wilmington, Del., has been appointed chemical director of the division, with headquarters at Wilmington. He will be succeeded at the Brandywine Laboratory by S. C. Lloyd.

FRITZ BLUETHGEN, head of the German Glanstoff-Bemberg interests, producers of rayon, recently arrived in the United States, where he will remain several weeks, devoting considerable time to a new mill project of the American division of the organization at Johnson City, Tenn.

BRUCE WAGNER is now with the laboratory research division of the Titanium Alloy Manufacturing Company, Niagara Falls, N. Y.

MAGNUS W. HELLGREN, technical manager, Uddeholms Co., Skoghall, Sweden, operating pulp and paper mills, is on a visit to the United States and will visit a number of plants of this kind, including several in Canada.

HOWARD A. POILLON has been appointed acting head of the Research Corporation, New York, to succeed A. A. Hammerslag, recently deceased.

C. B. FRANCIS, consulting chemist, for a number of years connected with the Carnegie Steel Company, Pittsburgh, Pa., as assistant chief chemist and later as chemist and metallurgist, has been appointed director of the bureau of technical education of the company, to succeed James M. Camp, who died recently. Mr. Francis has acted as assistant director of the bureau for several years.

PHILIP C. SCHERER has become chemist for the Brown Company, Berlin, N. H., operating pulp and paper mills

EDGAR M. QUEENY of the Monsanto Chemical Works, St. Louis, Mo., has sailed for a trip abroad to be absent several weeks.

ELMORE S. PETTIJOHN has been appointed director of research of the Michigan Gas Association with headquarters at Ann Arbor. He was formerly connected with the Semet-Solvay Corporation and the Ford Motor Company.

W. G. MACNAUGHTON, formerly secretary-treasurer of the Technical Association of the Pulp and Paper Industry, has resigned this position to become engineer of the Newsprint Service Bureau, New York City. Mr. MacNaughton has been secretary of T A P P I for the past six years. In his new position Mr. MacNaughton will be at the service of the newsprint industry of the United States and Canada in an advisory capacity.

G. D. BEARCE, engineer of the Newsprint Service Bureau of New York, has resigned this position to become a member of the manufacturing staff of the International Paper Company.

Dr. HUGH P. BAKER, executive secretary of the American Pulp and Paper Association and formerly dean of the New York State College of Forestry, will soon relinquish his present duties to take up those of the chairmanship of the newly created trade association committee of the United States Department of Commerce.

HARRY E. TUFFT is now with the Grasselli Chemical Company, Cleveland, Ohio, where he will specialize in wood preservation, especially to assist mine operators and engineers in the study of individual line timber needs.

E. HUMBOLDT, chemical engineer of Los Angeles, sailed for Europe Dec. 7 in connection with the construction of an alcohol plant for the Solvents Products, Ltd., of London.

J. B. KRAK has resigned his position with the Union Carbide Company (Elec-

tro Metallurgical Co.) of Niagara Falls, and has joined the ceramic department of the Roessler & Hasslacher Chemical Company, Perth Amboy, N. J., to take charge of glass research and technical service work in connection with the manufacture and sale of glass makers' chemicals. Before entering upon his new duties he will make a two months' trip to Europe to study the glass manufacturing industry of the principal European glass producing districts. Mr. Krak was formerly connected with the United States Window Glass Company, and with a number of other glass manufacturing concerns as consulting glass technologist.

GEORGE H. YOUNG, general manager of the Photogenic Machine Company, Youngstown, Ohio, has resigned in order to assume the presidency and direct the activities of the Birmingham Engineering Co., Birmingham, N. Y.

WILBERT W. WEIR, associate soil technologist of the Bureau of Chemistry and Soils, U. S. Department of Agriculture, has accepted a position on the staff of the Chilean Nitrate of Soda Educational Bureau with headquarters in New York City.

A. S. EICHLIN is now serving as research associate at the Bureau of Standards, working on problems of dyeing and cleaning in co-operation with the newly established National Institute for Dyeing and Cleaning, which is now occupying its new laboratories in the suburbs of Washington, D. C.

H. S. KENT has joined the staff of Joubert & Goslin Machine & Foundry Company, and will be located at the Birmingham plant where he will work particularly on vacuum filters.

JAMES D. CUNNINGHAM, president of the Republic Flow Meters Company, Chicago, has been elected to the office of president of the Illinois Manufacturer's Association.

R. L. OWEN, the Brazil representative of Joubert & Goslin Machine & Foundry Company, is in this country on a vacation.

PHILIP B. SADTLER, formerly vice-president of the Swenson Evaporator Company (a subsidiary of Whiting Corporation) Harvey, Ill., has been elected president of the Swenson Evaporator Company, to succeed the late N. S. Lawrence. Mr. Sadtler has been with the Swenson organization for about twenty years and during this time has handled a wide range of chemical engineering problems involving evaporation and heat transfer processes. He is a graduate of the Massachusetts Institute of Technology.

H. J. STRUTH, petroleum economist, has been appointed editor of *Natural Gas*, the official organ of the Natural Gas Department of the American Gas Association. He succeeds W. Re. Brown, the former editor, and will have his headquarters at 9 West Fourth St., Cincinnati, Ohio. Until recently, Mr. Struth was associate editor and economist of *Oil Trade* and *Fuel Oil*, in New York. He has been identified with several leading oil and gas companies as an economist and obtained his practical knowledge of the oil and gas business in the Mid-Continent fields.

HERBERT A. JOHNSON has been appointed New York manager of the Leipzig Trade Fair, Inc., 630 Fifth Ave., New York, to succeed the late E. A. Boettcher.

W. D. COOLIDGE, assistant director of the research laboratory of the General Electric Co., has been awarded the Hughes medal by the Royal Society for "distinguished work on X-rays and the development of highly efficient apparatus for their production."

ARTHUR A. ZENTNER sailed for Europe on December 9.

HAROLD W. FREVERT is now chemist at the Holland Tunnel for the New York Bridge and Tunnel Commission and the New Jersey Interstate Bridge and Tunnel Commission, New York, N. Y.

DAVID WESSON, chemist and chemical engineer and technical counselor of the Southern Cotton Oil Company, has removed his office to 111 South Mountain Ave., Montclair, N. J.

OBITUARY

WILLIAM EATON MERRITT, general plant superintendent of Armour Fertilizer Works, died suddenly on a Chicago elevated train while on his way to the office, Nov. 19, 1927. The nature of the sudden illness was not known. Mr. Merritt had recently been in good health and left home that morning in excellent spirits. He was born in Springfield, Ill., in 1881, where he lived until eighteen years of age. He was a nephew of General Wesley Merritt. In June, 1900, he received his appointment as cadet at the military academy at West Point, from which he graduated in June, 1905. His first civil employment after leaving the army was with Morris & Company, Chicago, from November, 1908, to March, 1909, when he entered the employ of Armour Fertilizer Works as a student in the manufacturing department, starting in the old fertilizer plant at the Union Stock Yards, Chicago. In December, 1909, he was transferred to Atlanta to continue his training under C. E. Cresse, then general superintendent of Armour Fertilizer Works.

In 1910 Mr. Merritt was made superintendent of the Tennessee Chemical Company, a subsidiary of Armour Fertilizer Works, in Nashville, Tenn. He left Nashville in July, 1918, to accept a position with the Calco Chemical Company, Bound Brook, N. J., as assistant works manager, remaining there until October, 1919. From October, 1919, to May, 1923, he was general works manager for the Victor Chemical Company, with plants in Nashville, Tenn., and Chicago Heights, Ill. From May, 1923, until September, 1923, he did special engineering work with the American Rolling Mill Company at Middletown, Ohio, for whom he made a comprehensive survey and report on inland waterways transportation. He re-entered the employ of Armour Fertilizer Works in September, 1923, as superintendent of the plant at Carteret, N. J., where he remained until July, 1924, when he was appointed general superintendent, with headquarters in Chicago. Mr. Merritt is survived by his wife, Martha; three children, Sarah, William and Martha; two sisters and one brother and a large host of friends.

ROBERT KEFFER, chief chemist for the Anaconda Copper Mining Co., at Butte, Mont., died recently at San Diego, Cal., aged 37 years.

ALONZO G. KINYON, consulting engineer with the Fuller Lehigh Company, Fullerton, Pa., died on Nov. 13, following an operation at Johns Hopkins Hospital, Baltimore, Md. Born in Amboy, Ill., in 1870, Mr. Kinyon early became associated with railway work in various stages. During the time he was connected with the railways he was identified with development in the fuel burning equipment and fuel conservation with different railway companies. He also served as an instructor in railway equipment and operation with the International Correspondence School. In 1915 Mr. Kinyon turned his attention to pulverized fuel joining a company connected with the use of pulverized coal on locomotives, and he was so impressed with the possibilities that he resolved to make improvements in the use of pulverized coal his main interest. Later Mr. Kinyon organized the Kinyon Pulverized Fuel Engineering Company to work out pulverized fuel application for hotel and apartment use and in September, 1918, became associated with the Fuller Lehigh Company with which he continued until his death. While his service to the various industries was marked by the contribution of valuable inventions in a wide variety of subjects, the outstanding point in Mr. Kinyon's career was the invention and development of the Fuller-Kinyon conveying system for transportaing pulverized material. This system is now widely used in many diversified industries. In recognition of his efforts he was on Nov. 11, 1926, awarded the Longstreth Medal by the Franklin Institute as well as life membership in that organization.

CALENDAR

AMERICAN CERAMIC SOCIETY, tour through France, Germany, Czechoslovakia and England, May 19-July 16, 1928.

AMERICAN CHEMICAL SOCIETY, spring meeting St. Louis, Mo., April 16-20, 1928.

AMERICAN ELECTROCHEMICAL SOCIETY, spring meeting, Bridgeport, Conn., April 26, 27 and 28, 1928.

NATIONAL SYMPOSIUM OF GENERAL ORGANIC CHEMISTRY (second) Ohio State University, Columbus, Ohio, Dec. 29-31.

European Chemical Cartel Reported To Have Been Consummated

British Dyestuff Interests Credited With Joining Germany and France in Dividing Export Markets

CREATION OF an international chemical cartel in Europe by agreement between France and Germany for the allocation and apportionment of world markets between the two countries is about to be consummated according to reliable but unofficial reports that the agreement was signed at Frankfort recently by representatives of the French and German dyestuffs industries and now awaits final approval by the Boards of Directors, the Department of Commerce has been advised.

While no official statement as to the details of the individual sections of the entente have yet been made public, Daniel J. Reagan, assistant commercial attaché at Paris, has previously reported the following items which it is stated have been confirmed by officials close to the negotiating groups.

THE arrangement for dyestuffs is already in operation, despite the failure to sign the accord while minor questions over market quotations have still to be settled. It is understood that the production quotas for Germany and France have been established by averaging the output for 1926, 1927, and the estimated output which each country anticipates for 1928 on the bases of the orders already received. The French industry considers that it has gained some success by having the actual and anticipated sales for 1928 taken into account because of the exceptionally large forward orders which it has already booked. On these bases, it is probable that the French quota has been established between 15,000 and 16,000 metric tons per year. This total, of course, does not include the dyestuffs produced in relatively small quantities by certain textile companies for their own consumption but which do not enter into the French trade in these products nor the output of the Swiss-owned plant at Sains-Fons, said to be approximately 1,200 metric tons in 1926.

In determining France's import and export quotas for coal-tar dyestuffs under the entente, it is impossible, of course, for this combination to control strictly the import factor. But in view of the fact that France has recently begun the production of a number of intermediate products including synthetic anthraquinone, the basis for the alizarine vat dyes, and beta-aminoanthraquinone, the basis for solan-threne dyes, its position in these negotiations has been distinctly improved. In 1926, one company alone introduced 95 new kinds of dyes, representing about 40 different dyes, among which the most important being the bromate-indigo series and the solanthrene dyestuffs, which were formerly imported almost entirely from Germany. By filling in these gaps, the French dyestuffs industry was in a strong trading position on the question of retaining the home market. The French producers are, however, still faced with the entry of reparations dyestuffs until the Fall of 1928. Since 1924, dye imports have remained at approximately 1,500 tons per year, although at the present rate, purchases for 1926 will probably exceed this amount by several hundred tons.

Exports for 1927, on the other hand, should approximate 5,300 tons as compared with 4,700 tons in 1926, and 5,000 tons in 1925. On the basis of these exports, and the estimated foreign sales for 1928, it is believed that the export quota sought by the French in this entente approximates 5,500 metric tons, or slightly in excess of one-third of the French output.

As for price-control, there has been the usual denial of hard and fast price fixing. It is admitted, however, by those close to the parties interested in this entente, that "unofficial" price arrangements are already in operation.

WITHIN the last few days, cable advices state that British dyestuffs interests have joined with France and Germany in this agreement. The agreement is reported to have now been signed by the boards of French and German companies and awaits only British government sanction before being made formally effective as of Jan. 1, 1928. Swiss dyestuffs producers are negotiating for entry into this entente.

The terms relative to the division of export markets among the three signatory countries is based upon their 1926 total dyestuffs exports as follows: France, 12 per cent; Germany, 75 per cent; and Great Britain, 13 per cent. Each country reserves its home markets except that each agrees to purchase from other members those dyestuffs not made nationally.

France and Germany agree to exchange process information. Colonies and protectorates are considered export markets. The French quota is to be allocated as follows, according to the reports: Kuhlmann, 60 per cent; St. Denis, 30 per cent; (Kuhlmann associate) St. Clair du Rhone, 10 per cent.

Favorable progress in the formation of a Synthetic Nitrogen Entente between France, Germany, and Great Britain to meet competition from natural nitrates through a common sales program is reported. Persons close to the European negotiating interests are reported as saying that without American participation the program can not be entirely successful.

WHILE less is now known as to the exact details governing the rayon clause its general lines are admitted to follow those for dyestuffs. Production quotas for each of the contracting countries are based upon the average output for the years 1925-1926-1927 (on the basis of the production so far achieved this year). This would mean a production quota for France of approximately 7,000 metric tons. Export contingents are said to have been based upon an average for the same period, although the contingents allotted for the individual foreign markets are still subject to review. In well informed circles, it is believed that an effort will be made towards at least a gentleman's agreement upon export prices, although the condition of the world markets would seem to make the maintenance of such an arrangement extremely difficult.

Of interest in connection with these negotiations is the press report that the Comptoir Francais des Textiles Artificiels has concluded an agreement with the European rayon cartel for the exploitation of the Celta process. Furthermore, the difficulties which have divided the French group and Courtaulds over the question of the manufacture of a special viscose silk, which has particular qualities of lightness and warmth, have been settled through the intervention of Glanzstoff. Furthermore, this latter company is reported to have established, with the Comptoir Francais, a German rayon company, known as the "Zelta A.G." Besides its rapproachement with the Germans, the Comptoir des Textiles is continuing its discussion with the British "Celanese."

The final terms of this section of the agreement have not yet been established because, as stated above, of the demand of the French for a further review of world market conditions, while awaiting the results of the Franco-British and German-British discussions of these products.

Quicksilver Deposits in Nevada

Important quicksilver deposits in the Pilot Mountains of western Nevada are described in a bulletin of the Geological Survey, Department of the Interior, just issued by the Survey as Bulletin 795-E. The deposits are situated in the heart of the Pilot Mountains, especially on the east and west flank of one of the main ridges, which has been named Cinnabar Mountain on account of the presence of cinnabar, the chief ore mineral of quicksilver. The nearest town is Mina, 12 miles away. Production from these mines began in 1915. All the ore mined to date has been of high grade, much of it with a content of over 10 per cent of quicksilver and some of it even the pure ore mineral. Low-grade ore has not been utilized but is stated by the Geological Survey to be present in some abundance.

MARKET CONDITIONS *and* PRICE TRENDS

Chemical Production Remains Below Last Year's Levels

INDUSTRIAL activities have continued along relatively quiet lines throughout the last month and within the chemical industry, conditions have followed the general trend. Basic industries such as steel and iron reported production in November as being close to the low of the year. Carloadings for the month also were lower and other business indices, including outputs of byproduct coke and automobiles, showed up in unfavorable comparison with those for the corresponding period of last year.

Consumption of chemicals as computed from a survey of the principal consuming industries is maintaining a high level but is not up to the standards of a year ago. Overproduction of paper has brought about a curtailment in the manufacture of pulp and paper; plate glass production has declined materially; spotted conditions prevail in the textile industry; rayon manufacture is running ahead of last year, oil refining is less active although vegetable oil refiners have been more active than they were last year.

EMPLOYMENT figures bear out reports that general production is not as large as it was a year ago. The Bureau of Labor in its monthly review shows that employment in manufacturing industries in October was 5.3 per cent lower than in October, 1926. The weighted index numbers for October with comparisons were as follows:

Indexes of Employment

	Oct., 1927	Sept., 1927	Oct., 1926
Dyeing and finishing textiles	100.1	98.3	97.6
Leather	88.8	89.2	92.1
Paper and pulp	93.3	93.3	96.2
Chemicals	96.3	95.3	96.9
Fertilizers	91.8	95.2	104.9
Petroleum refining	87.9	91.1	102.7
Glass	93.3	92.5	102.0
Automobile tires	102.1	106.7	112.7
All manufacturing	87.6	88.0	92.5

These index numbers indicate that falling off in chemical production has been less pronounced than that for industry as a whole and with the automobile, tire, glass, and fertilizer industries showing signs of recoveries the outlook for production and consumption of chemicals is promising. The fertilizer industry not only recorded advances in output over September but registered a gain of 12.8 per cent over the total for October last year. Chemical pulp production in October was 215,508 tons as compared with 235,848 tons for October, 1926. Acetate of lime and methanol show declines as compared with a year ago but the falling off is not as large as might have been expected in view of increased offerings of synthetic methanol. Oleomargarine has been finding a large outlet and has accounted for a much larger disappearance of vegetable oils than was the case last year.

ACCORDING to the report of the Department of Commerce production of raw materials in October was greater than in either the previous month or October, 1926, increases occurring over both prior periods in the marketings of animal products and crops. Although mineral production was greater than in September, it was lower than a year ago, while in the case of forestry production, a decline was registered from September, the October output, however, being on the same level as in the previous year.

The production of manufactured commodities, after adjustment for working-time differences, was smaller than in either the previous month or October of last year. As compared with the preceding month, without adjustment for differences in working time, larger production was registered in foodstuffs, iron and steel and chemicals and oils, all other groups either declining or showing no change. Contrasted with a year ago, October production showed increases in foodstuffs, textile, leather, chemicals and oils, stone and clay products, and tobacco manufactures, other groups showing declines.

Stocks of commodities, after adjustment for seasonal conditions, were held in smaller quantities than in the preceding month, but were higher than a year ago. As compared with the previous month, stocks of raw and manufactured foodstuffs and other manufactured commodities were lower, while the holdings of raw materials, other than foodstuffs, were higher. As compared with a year ago, all major groups showed larger stocks, except raw foodstuffs, which were smaller. The general unadjusted index of commodity stocks showed larger holdings at the end of October than at the end of either prior period.

The index of unfilled orders, principally for iron and steel and building materials, was lower at the end of October, than at the end of either the previous month or October of last year. While forward orders for iron and steel showed an increase over the previous month, the advance was insufficient to offset a decline in building materials.

PRICES for chemicals, especially those where large tonnage is involved, have been well stabilized and only minor changes were reported during the past month. Principal interest in quotations centers in those applying on contracts. In some cases contract prices for 1928 are lower than they were for 1927 but these reductions are little better than nominal in view of the fact that open quotations were not adhered to last year and actual sales were made at prices approximating those now openly quoted. Oils and facts, on the other hand, show frequent price fluctuations with the present trend downward. Cottonseed oil is affected by the large carryover from the preceding season. Linseed oil is quiet and low in price with developments in Argentine markets as the prime factor in influencing future values.

DURING October, exports of chemicals and allied products amounting to $14,800,000 were 4 per cent less while imports equaling $18,478,000 were 16 per cent more than in October, 1926. Among the more important reductions in exports were those of naval stores, coal-tar products, fertilizers, and explosives. Sulphur shipments were double those of the previous October, and medicinal and pharmaceutical preparations were one tenth more. The leading commodities contributing to the increase in imports were gums and resins, creosote oil, colors, dyes, and stains, perfume materials, and fertilizers.

Whereas a year ago exports of crude coal tar products, especially benzol, were exceptionally high, those of this October were small and contributed chiefly to the 25 per cent decrease in exports of all coal tar products to $975,000 for the month. Colors, dyes, and stains were reduced 17 per cent in quantities to 1,840,000 lb. valued at $400,000.

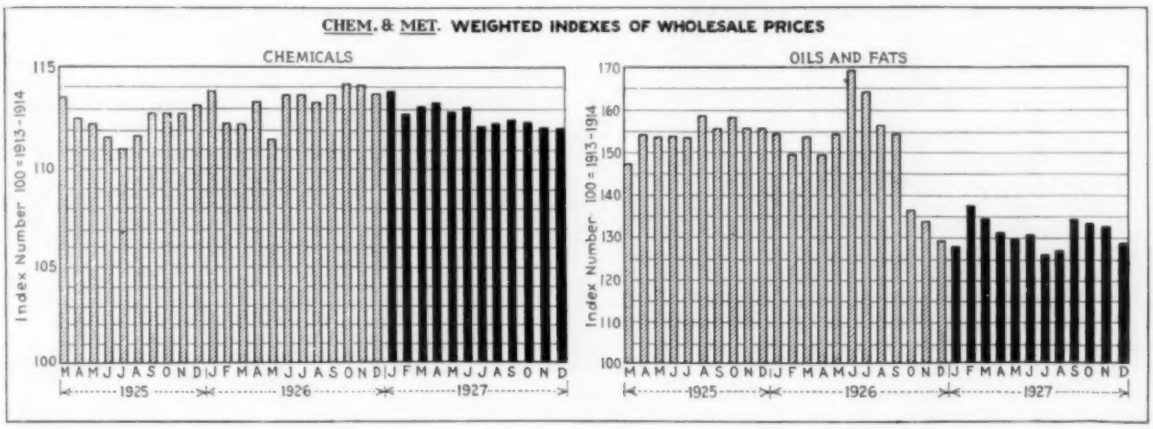
In contrast to the decline in exports, imports of all coal tar products doubled to $2,567,000. Incoming shipments of creosote oil were unusually large and amounted to $1,886,000 (10,951,000 gal.). Approximately one seventh more or a total of $500,000 (480,000 lb.) of colors, dyes, and stains, were imported in October, 1927.

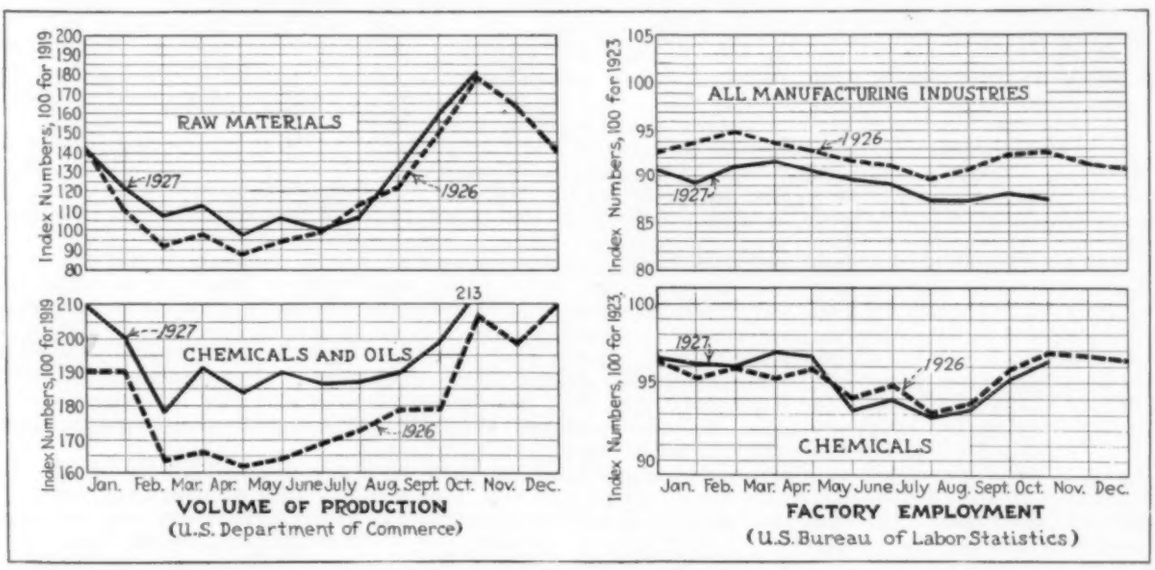
Chiefly on account of a continued strong demand for American borax, and for disinfectants, insecticides, fungicides, and similar preparations, exports of industrial chemicals were 5 per cent more than in October, 1926, and equaled $2,722,000, a figure $350,000 above that of imports. Considerably smaller amounts of calcium carbide, and of crude glycerin entering the United States in October, 1927, than in October, 1926, are the chief causes for a total decline of 21 per cent of all industrial chemicals imported to $2,372,000.

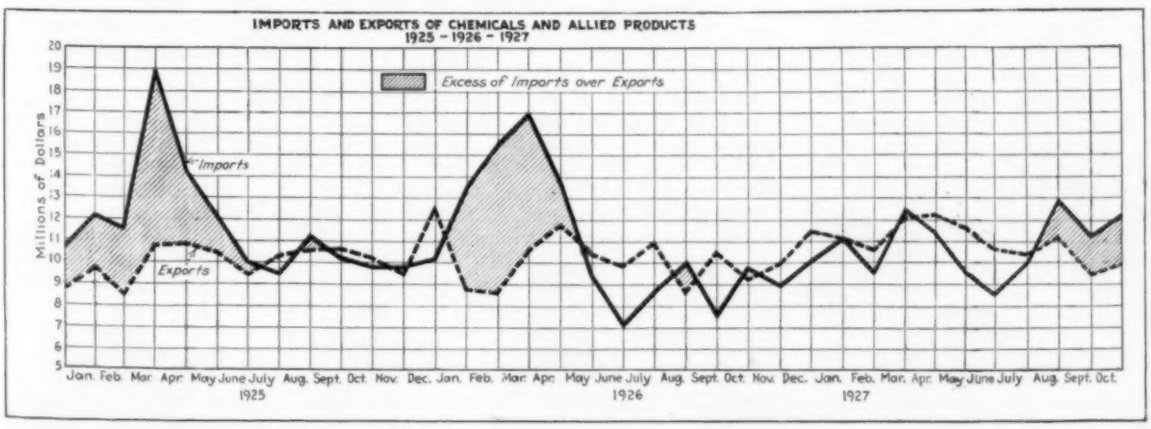
The pigments, paints, and varnish trade changed but little, exports amounting to $1,477,000 and imports less than one quarter as much or $327,000. Of interest in this group, was the continued expansion in sales of varnishes other than oil, including lacquers.

CHEM. & MET. STATISTICS OF BUSINESS

IN THE CHEMICAL ENGINEERING INDUSTRIES







MARKET CONDITIONS *and* PRICE TRENDS

Contract Commitments for Chemicals Less Active

Falling Off in Buying Orders Reported for Alkalies and Other Selections

LARGE CONSUMERS of heavy chemicals, especially of alkalies, were reported to be slow in placing contract commitments during the past month. The volume of such business is said to compare unfavorably with the total for November last year. Prices quoted for 1928 deliveries are entirely acceptable but uncertainty about future conditions is said to be influencing consuming trades to hold off until a clearer idea may be obtained regarding probable amounts they will require. In the case of liquid chlorine, buyers have been friendly to the market since the lower schedule of prices was announced and a good tonnage has been sold for delivery over next year. Considerable opposition had been voiced by users of liquid chlorine before the reduction in price but the situation has been clarified and the probability of new sources of production has been dissipated.

The ammonia products, aqua and anhydrous, have been working into a stronger position and higher prices have been obtained by sellers. The advance in price was not general but the new and higher-priced figures seem to meet with very little opposition and the keen rivalry which existed in the market for the last two years apparently has abated, but with production on a large scale the stability of prices may depend on the ability of the market to absorb offerings.

IMPROVEMENT was reported in demand for alcohol and other materials used for anti-freeze purposes. Weather conditions have been unfavorable for an active market but distribution into consuming channels broadened during the month and stocks in distributors' hands were decreased. In view of the anticipated increase in consumption, prices for alcohol are steady with resale lots apparently small. Glycerin, while expected to find an increased outlet, has shown a weak tone and shading of prices has been rumored. Stocks of glycerin are reported as large and jobbers are said to have been offered favorable terms in order to influence them to take on stocks. Importers also are competing in the glycerin market which adds to the weakness of values. It is too early to determine to what extent sales of glycerin will affect the use of alcohol in the anti-freeze trade, but the fact that production of alcohol is to be regulated is of more importance as a price factor, although future prices may be more in buyers' favor as a result of lower cost of production if rumors are verified that molasses will be available below present contract levels.

SILICATE of soda has been going out steadily on contracts and enlarged uses for this chemical are said to have enlarged production. The use of silicate for road making is reported to have reached considerable size, so much so that it has become a competitor of other chemicals which formerly had a monopoly in that field.

Bichromate of soda has shown no new features in recent trading and as the majority of large consumers have covered future requirements the present market is inactive. Chromic acid has been of interest by reason of the demand in the plating trade and production promises to show material gains in the coming year.

The course of the metal markets has had an influence on chemical products with different advances in price traceable to higher selling levels for the basic materials. Advances in pig lead were responsible for higher prices for red lead, litharge, and orange mineral. Tin crystals, bichloride of tin, and anhydrous tetrachloride of tin reached higher levels following rises in the metal market. Copper also moved upward in price and a strong market rules for copper sulphate. Incidentally a good trading movement has characterized the market for copper sulphate and higher prices seem inevitable unless foreign competition has sufficient influence to hold the market in check.

SPIRITS of turpentine and gum rosin continue in a depressed condition and with large stocks in sight it will take a sustained buying movement to restore the equilibrium of the market. The low prices which have ruled have failed to increase export trade and October shipments to foreign markets were smaller than a year ago. The most important development in the naval stores trade was an announcement by the Naval Stores Unit of the Bureau of Chemistry and Soils to the effect that a new still had been developed whereby steam could be utilized in the production of turpentine and rosin. It is stated that while turpentine was formerly more valuable than the rosin, the situation now is usually reversed. Rosin is now more valuable than turpentine and operators are desirous of producing the highest grade of rosin possible. The new steam still meets that requirement and many others as well. Results of experiments in which the several kinds of gums collected at various times of the year were distilled indicate that this steam still will produce a uniformly higher grade of rosin than the old-fire still, and larger yields of turpentine; and that it will do the work with less fuel and more speed, and consequently with less cost than was possible with the fire still. Another very decided advantage is the greater safety with which the steam still may be operated.

The operation of the steam still does not differ very widely from that of the fire still. The heat to bring about distillation is obtained from a system of closed coils ingeniously placed inside the still so that all gum will be uniformly cooked, and without interfering with skimming or discharging the rosin. Live steam takes the place of water usually fed into the still to carry over the turpentine but is brought in at the bottom of the still through a sparger. Steam pressure is maintained at 125 lb. during the run, and steam going into the stills must be perfectly dry.

COAL-TAR chemicals are featured by the strong tone to cresylic acid. The domestic output is light and production in foreign markets is pretty well taken up with only a small surplus for export, consequently the import price is holding firm with no indication of a change in conditions. Benzol continues to be in ample supply and prices are none too steady but the output has been curtailed and the market is working into a position where there will be a more equal balance between supply and demand. Greater competition is expected in the market for aniline oil as some producers have enlarged their outputs.

ON DECEMBER 8, the Department of Commerce issued its final report on the cotton crop and placed the outturn at 12,789,000 bales of 500 lb. gross weight each. While this report showed a smaller total than that reported as of November 1, the effect on the market for cottonseed oil was bearish and values for oil were adversely affected. While the supply of cottonseed is considerably less than from the 1926 crop, the large supply of oil carried over into the present season will give a total oil supply in excess of consuming needs and present reports favor an increase in the cotton acreage next Spring as planters are said to be reserving a larger area for cotton. Moreover, sales of fertilizer for future delivery are running ahead of those of a year ago and this would forecast a larger yield per acre.

Linseed oil is moving seasonably against contracts but many consumers are not covered far ahead and seem to be basing hopes of lower prices on a record flaxseed crop in the Argentine. European markets have shown an ability to absorb large amounts of seed and unless buying from that quarter declines

MARKET CONDITIONS *and* PRICE TRENDS

Chem. & Met. Weighted Index of Chemical Prices

Base = 100 for 1913-14

This month	**112.08**
Last month	112.02
December, 1926	113.71
December, 1925	113.11

The more important chemicals showed very little price fluctuations in recent weeks. The ammonia market was in a firmer position and higher prices were realized for lead oxides. The weighted index number was slightly higher.

the probability of material declines in seed and oil prices does not seem encouraging. Domestic markets for the near future may be influenced more by demand for oil than by fluctuations in foreign markets for seed.

According to reports from China, the new crop of wood oil has been harvested and is now being marketed. The crop is described as good and for the fiscal year beginning Dec. 1, not less than 72,000,000 lb. will be available for export from central China. The market has been a little easier especially in forward positions.

Wood chemicals show no material change. Production of crude methanol in October was 643,491 gal., which compares with 576,947 gal. in October last year. October output of refined methanol was 688,435 gal. as against 618,284 gal. in October, 1926. Acetate of lime production in October was 13,911,770 lb. compared with 14,002.232 lb. in October, 1926. In the case of acetate of lime the domestic output in the 10-month period ended October was larger than in the corresponding period of 1926 but production of both crude and refined methanol was smaller with the largest decline recorded for the refined product. That producers of these wood chemicals have been working at a disadvantage is attested by the fact that one of the large producing companies has just been petitioned into bankruptcy.

Chem. & Met. Weighted Index of Prices for Oils and Fats

Base = 100 for 1913-14

This month	**128.30**
Last month	132.90
December, 1926	128.94
December, 1925	156.13

Declines in price were almost general throughout the oil and fat markets last month. Cottonseed, coconut, corn, and peanut oils sold at lower levels and the same was true of tallow and other fats. Paint-making oils were fairly steady.

CURRENT PRICES *in the* NEW YORK MARKET

For Chemicals, Oils and Allied Products

The following prices refer to round lots in the New York Market. Where it is the trade custom to sell f.o.b. works, quotations are given on that basis and are so designated. Prices are corrected to December 12.

Industrial Chemicals

		Current Price	Last Month	Last Year
Acetone, drums	lb.	$0.12 -$0.13	$0.12 -$0.13	$0.12 -$0.13
Acid, acetic, 28%, bbl.	cwt.	3.38 - 3.63	3.38 - 3.63	3.25 - 3.50
Boric, bbl.	lb.	.08½- .08¾	.08½- .08¾	.08½- .11
Citric, kegs	lb.	.44½- .45	.44½- .45	.45 - .47
Formic, bbl.	lb.	.11 - .12	.10½- .11	.10½- .11
Gallic, tech., bbl.	lb.	.50 - .55	.50 - .55	.45 - .50
Hydrofluoric 30% carb.	lb.	.06 - .07	.06 - .07	.06 - .07
Lactic, 44%, tech., light, bbl.	lb.	.13½- .14	.13½- .14	.13½- .14
22%, tech., light, bbl.	lb.	.06½- .07	.06½- .07	.06½- .07
Muriatic, 18°, tanks	cwt.	.85 - .90	.85 - .90	.85 - .90
Nitric, 36°, carboys	cwt.	.05 - .05½	.05 - .05½	.05 - .05½
Oleum, tanks, wks.	ton	18.00 -20.00	18.00 -20.00	18.00- 20.00
Oxalic, crystals, bbl.	lb.	.11 - .11½	.11 - .11½	.10½- .11
Phosphoric, tech., c'boys	lb.	.08½- .09	.08½- .09	.07 - .07½
Sulphuric, 60°, tanks	ton	10.50 -11.00	10.50 -11.00	10.50 -11.00
Tannic, tech., bbl.	lb.	.35 - .40	.35 - .40	.35 - .40
Tartaric, powd., bbl.	lb.	.36 - .37½	.37 - .37½	.29 - .30
Tungstic, bbl.	lb.	1.00 - 1.20	1.00 - 1.20	1.00 - 1.20
Alcohol, ethyl, 190 p'f. U.S.P. bbl.	gal.	3.75 - 4.00	3.75 - 4.00	4.85 - 4.90
Alcohol, Butyl, dr.	lb.	.19 - .20½	.19½- .20½	.18½- .19
Denatured, 190 proof No. 1 special dr.	gal.	.48 -	.48	.31 - .....
No. 5, 188 proof, dr.	gal.	.48 -	.48	.31 - .32
Alum, ammonia, lump, bbl.	lb.	.03½- .04	.03½- .04	.03½- .04
Chrome, bbl.	lb.	.05½- .05¾	.05½- .05¾	.05½- .06
Potash, lump, bbl.	lb.	.02½- .03½	.02½- .03½	.02½- .03½
Aluminum sulphate, com., bags	cwt.	1.40 - 1.45	1.40 - 1.45	1.40 - 1.45
Iron free, bg.	cwt.	2.00 - 2.10	2.00 - 2.10	2.00 - 2.10
Aqua ammonia, 26°, drums	lb.	.03 - .04	.02½- .03½	.03½- .04
Ammonia, anhydrous, cyl.	lb.	.12 - .13	.11 - .15	.13 - .15
Ammonium carbonate, powd. tech., casks	lb.	.10½- .14	.10½- .14	.11 - .14
Sulphate, wks.	cwt.	2.40 -	2.40 -	2.50 - .....
Amylacetate tech., drums	gal.	1.75 - 2.00	2.15 - 2.20	1.80 - 1.90
Antimony Oxide, bbl.	lb.	.15 - .16½	.16 - .17½	.14½- .15
Arsenic, white, powd., bbl.	lb.	$0.04 -$0.04½	$0.04 - .04½	$0.03½- .04½
Red, powd., kegs	lb.	.09½- .10	.09½- .10	.11 - .12
Barium carbonate, bbl.	ton	50.00 -52.00	50.00 -52.00	48.00 -50.00
Chloride, bbl.	ton	56.00 -58.00	58.00 -60.00	63.00 -65.00
Nitrate, cask	lb.	.08 - .08½	.08 - .08½	.07½- .08
Blanc fixe, dry, bbl.	lb.	.04 - .04½	.04 - .04½	.04 - .04½
Bleaching powder, f.o.b., wks., drums	cwt.	2.00 - 2.10	2.00 - 2.10	2.00 - 2.10
Borax, bbl.	lb.	.04 - .04½	.04½- .05	.05 - .05½
Bromine, cs.	lb.	.45 - .47	.45 - .47	.45 - .47
Calcium acetate, bags	cwt.	3.50 -	3.50 -	3.25 - 3.50
Arsenate, dr.	lb.	.07½- .08	.07½- .08	.07½- .08
Carbide drums	lb.	.05 - .06	.05 - .06	.05 - .06
Chloride, fused, dr., wks.	ton	21.00 -	21.00 -	21.00 - .....
Phosphate, bbl.	lb.	.07 - .07½	.07 - .07½	.07 - .07½
Carbon bisulphide, drums	lb.	.05½- .06	.05½- .06	.05½- .06
Tetrachloride drums	lb.	.06½- .07	.06½- .07	.06½- .07
Chlorine, liquid, tanks, wks.	lb.	.03½- .04½	.04 - .04½	.04 - .04½
Cylinders	lb.	.05½- .08	.05½- .08	.05½- .08
Cobalt oxide, cans	lb.	2.00 - 2.10	2.00 - 2.10	2.10 - 2.25
Copperas, bgs., f.o.b. wks.	ton	14.00 -17.00	14.00- 17.00	13.00 -15.00
Copper carbonate, bbl.	lb.	.17 - .17½	.17 - .18	.16½- .17
Cyanide, tech., bbl.	lb.	.49 - .50	.49 - .50	.49 - .50
Sulphate, bbl.	cwt.	5.00 - 5.10	5.00 - 5.10	4.90 - 5.00
Cream of tartar, bbl.	lb	.27 - .28	.27½- .28	.21 - .22
Diethylene glycol, dr.	gal.	.15 - .20	.15 - .20	.....
Epsom salt, dom., tech., bbl.	cwt.	1.75 - 2.15	1.75 - 2.00	1.75 - 2.00
Imp., tech., bags	cwt.	1.15 - 1.25	1.15 - 1.25	1.35 - 1.40
Ethyl acetate, 85% drums	gal.	.74 - .76	.74 - .76	.74 - .76
Formaldehyde, 40%, bbl.	lb.	.08½- .08¾	.08½- .11¼	.09 - .09½
Furfural, dr.	lb.	.15 - .17½	.15 - .17½	.15 - .17
Fusel oil, crude, drums	gal.	1.30 - 1.40	1.30 - 1.40	1.40 - 1.50
Refined, dr.	gal.	2.50 - 3.00	2.50 - 3.00	2.50 - 3.00
Glaubers salt, bags	cwt.	1.00 - 1.15	1.00 - 1.10	1.20 - 1.40
Glycerine, e.p., drums, extra	lb.	.21½- 22	.23 - .24	.30 - .....
Lead: White, basic carbonate, dry, casks	lb.	.09 -	.09 -	.10½- .....
White, basic sulphate, sck.	lb.	.08½-	.08½-	.09½- .....
Red, dry, sck.	lb.	.10 -	.09½-	.11½- .....
Lead acetate, white crys., bbl.	lb.	.13 - .13½	.13 - .13½	.14½- .....
Lead arsenate, powd., bbl.	lb.	.12 - .13	.12 - .13	.14 - .15
Lime, chem., bulk	ton	8.50 -	8.50 -	8.50 - .....
Litharge, pwd., csk.	lb.	.09 -	.08½-	.10½- .....
Lithopone, bags	lb.	.05½- .06	.05½- .06	.05½- .06½
Magnesium carb., tech., bags	lb.	.07½- .08	.07½- .08	.06½- .06½
Methanol, 95%, dr.	gal.	.53 - ..55	.53 -	.75 - .....
97%, dr.	gal.	.55 -	.55 -	.77 - .....
Nickel salt, double, bbl.	lb.	.10 - .10½	.10 - .10½	.09 - .10
Single, bbl.	lb.	.10½- .11	.10½- .11	.10 - .11

Industrial Chemicals (Continued)

		Current Price	Last Month	Last Year
Orange mineral, csk.	lb.	$0.11½-	$0.11½-	$0.13½-
Phosphorus, red, cases	lb.	.62 -$0.65	.62 -$0.65	.65 -$0.68
Yellow, cases	lb.	.32 - .33	.32 - .34	.33 - .34
Potassium bichromate, casks	lb.	.08½- .08½	.08½- .08½	.08½- .08½
Carbonate, 80-85%, calc., csk.	lb	.05½- .06	.05½- .06	.06½- .06½
Chlorate, powd.	lb.	.08½- .09	.08½- .09	.08½- .09
Cyanide, cs.	lb.	.55 - .57	.55 - .58	.55 - .57
First sorts, csk.	lb.	.09 - .09½	.08½- .09	.08½- .09
Hydroxide(c'stic potash)	dr.lb.	.07½- .07½	.07½- .07½	.07½- .07½
Muriate, 80% bgs	ton	36.40 -.....	36.40 -.....	36.00 -.....
Nitrate, bbl.	lb.	.06 - .06½	.06 - .06½	.06 - .07½
Permanganate, drums	lb.	.15 - .16	.14 - .15	.14½- .15
Prussiate, yellow, casks	lb.	.18 - .19	.18½- .19	.18 - .19
Sal ammoniac, white, casks	lb.	.05 - .05½	.05½- .06½	.05½- .06
Salsoda, bbl.	cwt.	.90 - .95	.90 - .95	.90 - .95
Salt cake, bulk	ton	17.00 -18.00	17.00 -18.00	17.00 -19.00
Soda ash, light, 58%, bags, contract	cwt.	1.32 -.....	1.32½-.....	1.38 -.....
Dense, bags	cwt.	1.35 -.....	1.37½- 1.55	1.45 - 1.55
Soda, caustic, 76%, solid, drums, contract	cwt.	2.80 - 3.00	3.00 -.....	3.10 -.....
Acetate, works, bbl.	lb.	.04½- .05½	.04½- .05	.04½- .05
Bicarbonate, bbl.	cwt.	2.00 - 2.25	2.00 - 2.25	2.00 - 2.25
Bichromate, casks	lb.	.06½- 06½	.06½- .06½	.06½- .06½
Bisulphate, bulk	ton	3.00 - 3.50	5.00 - 5.50	6.00 - 7.00
Bisulphite, bbl.	lb.	.03½- .04	.03½- .04	.03½- .04
Chlorate, kegs	lb.	.06½- .06½	.06½- .06½	.06½- .06½
Chloride, tech.	ton	12.00 -14.75	12.00- 14.75	12.00 -14.00
Cyanide, cases, dom.	lb.	.18 - .22	.18 - .22	.19 - .22
Fluoride, bbl.	lb.	.08½- .09	.08½- .09	.08½- .09
Hyposulphite, bbl.	lb.	2.50 - 3.00	2.50 - 3.00	2.65 - 3.00
Nitrate, bags	cwt.	2.40 -.....	2 30 -.....	2.36 -.....
Nitrite, casks	lb.	.08½- .08½	.08½- .08½	.08½- .09
Phosphate, dibasic, bbl.	lb.	.03 - .03½	.03½- .03½	.03½- .03½
Prussiate, yel. drums	lb.	.12 - .12½	.12 - .12½	.10 - .10½
Silicate (30°, drums)	cwt.	.75 - 1.15	.75 - 1.15	.75 - 1.15
Sulphide, fused, 60-62%, dr.	lb.	.03½- .04	.03½- .04	.0½- .03
Sulphite, crys., bbl.	lb.	.03 - .03½	.03 - .03½	.02½- .03
Strontium nitrate, bbl.	lb.	.09 - .09½	.08½- .09	.08½- .09
Sulphur, crude at mine, bulk	ton	19.00 -.....	19.00 -.....	19.00 -20.00
Chloride, dr.	lb.	.04 - .05	.04 - .05	.05 - .05½
Dioxide, cyl.	lb.	.09 - .10	.09 - .10	.09 - .10
Flour, bag	cwt.	2.70 - 3.00	2.70 - 3.00	2.70 - 3.00
Tin bichloride, bbl.	lb.	.17½-	.17½-	.19 -.....
Oxide, bbl.	lb.	.64 -.....	.64 -.....	.67 -.....
Crystals, bbl.	lb.	.42 -.....	.42 -.....	.48 -.....
Zinc chloride, gran., bbl.	lb.	.06½- .06½	.06½- .06½	.07 - .07½
Carbonate, bbl.	lb.	.10 - .11	.10 - .10½	.10½- .11
Cyanide, dr.	lb.	.40 - .41	.40 - .41	.40 - .41
Dust, bbl.	lb.	.09 - .10	.10½- .11	.09 - .10
Zinc oxide, lead free, bag	lb.	.06½-	.06½-	.07½- .....
5% lead sulphate, bags	lb.	.06½-	.06½-	.07½- .....
Sulphate, bbl	cwt.	2.75 - 3.00	2.75 - 3.00	2.75 - 3.00

Oils and Fats

		Current Price	Last Month	Last Year
Castor oil, No. 3, bbl.	lb.	$0.13 -$0.13½	$0.13 -$0.13½	$0.12½-$0.13
Chinawood oil, bbl.	lb.	.15½-.....	.15 -.....	.16½-.....
Coconut oil, Ceylon, tanks, N. Y.	lb.	.08½-.....	.08½-.....	.09½-.....
Corn oil crude, tanks, (f.o.b. mill)	lb.	.09½-.....	.10 -.....	.10½-.....
Cottonseed oil, crude (f.o.b. mill), tanks	lb.	.08½-.....	.09½-.....	.06½-.....
Linseed oil, raw, car lots, bbl.	lb.	.096-.....	.096-.....	.107 -.....
Palm, Lagos, casks	lb.	.08 -.....	.07½- .08	.08½-.....
Niger, casks	lb.	.07½-.....	.07½- .07½	.08½-.....
Palm Kernel, bbl.	lb.	.09 -.....	.09 -.....	.10½-.....
Peanut oil, crude, tanks(mill)	lb.	.09½-.....	.09½-.....	.13 -.....
Perilla, bbl.	lb.	.....	.....	.....
Rapeseed oil, refined, bbl.	gal.	.85 - .86	.85 - .86	.84 - .86
Sesame, bbl.	lb.	.....	.....	.....
Soya bean tank (f.o.b. Coast)	lb.	.09½-.....	.09½-.....	.10½-.....
Sulphur(olive foots), bbl.	lb.	.10 -.....	.09½-.....	.08½-.....
Cod, Newfoundland, bbl	gal.	.63 - .62	.63 - .64	.60 - .65
Menhaden, light pressed, bbl.	gal.	.60 - .66	.60 - .62	.65 - .68
Crude, tanks(f.o.b. factory)	gal.	.44 -	45 -.....	.45 -.....
Whale, crude, tanks	lb.	.....	.....	.....
Grease, yellow, loose	lb.	.06½-.....	.06½-.....	.08½-.....
Oleo stearine	lb.	.12½-.....	.12½-.....	.12½-.....
Red oil, distilled, d.p. bbl.	lb.	.09½- .09½	.09½- .10	.10 - .10½
Tallow, extra, loose	lb.	.08½-.....	.08 -.....	.07½-.....

Coal-Tar Products

		Current Price	Last Month	Last Year
Alpha-naphthol, crude, bbl.	lb.	$0.60 -$0.65	$0.60 -$0.65	$0.60 -$0.62
Refined, bbl	lb.	.85 - .90	.85 - .90	.85 - .90
Alpha-naphthylamine, bbl.	lb.	.35 - .36	.35 - .36	.35 - .36
Aniline oil, drums, extra	lb.	.15 - .16	.15 - .16	.16 - .16½
Aniline salts, bbl	lb.	.24 - .25	.24 - .25	.22 - .23½
Anthracene, 80%, drums	lb.	.60 - .65	.60 - .65	.60 - .65½
Benzaldehyde, U.S.P., dr.	lb.	1.15 - 1.25	1.15 -$1.35	1.30 - 1.35
Benzidine base, bbl.	lb.	.70 - .72	.70 - .75	.72 - .74
Benzoic acid, U.S.P., kgs.	lb.	.58 - .60	.58 - .60	.56 - .60
Benzyl chloride, tech, dr	lb.	.25 - .26	.25 - .26	.25 - .26
Benzol, 90%, tanks, works	gal.	.24 - .25	.24 - .25	.24 - .25
Beta-naphthol, tech., drums	lb.	.22 - .24	.22 - .24	.22 - .24
Cresol, U.S.P., dr.	lb.	.18 - .20	.18 - .20	.18 - .20
Cresylic acid, 97%, dr., wks	gal.	.61 - .62	.61 - .62	.60 - .65
Diethylaniline, dr	lb.	.58 - .60	.58 - .60	.58 - .60
Dinitrophenol, bbl.	lb.	.31 - .35	.31 - .33	.31 - .35
Dinitrotoluen, bbl.	lb.	.17 - .18	.17 - .18	.18 - .20
Dip oil, 25% dr	gal.	.28 - .30	.28 - .30	.28 - .30
Diphenylamine, bbl.	lb.	.45 - .47	.45 - .47	.48 - .50
H-acid, bbl.	lb.	.63 - .65	.63 - .65	.65 - .66
Naphthalene, flake, bbl.	lb.	.04½- .05	.04½- .05	.06½- .07
Nitrobenzene, dr.	lb.	.09 - .10	.09 - .10	.09 - .10
Para-nitraniline, bbl.	lb.	$0.52 -$0.53	$0.52 -$0.53	$0.50 -$0.53
Para-nitrotoluine, bbl.	lb.	.28 - .32	.28 - .32	.40 - .42
Phenol, U.S.P., drums	lb.	.18 - .19	.18 - .19	.17 - .18
Picric acid, bbl.	lb.	.30 - .40	.30 - .40	.25 - .26
Pyridine, dr.	lb.	3.00 -.....	3.00 -.....	3.90 - 4.00
R-salt, bbl.	lb.	.47 - .50	.47 - .50	.50 - .55
Resorcinal, tech, kegs	lb.	1.30 - 1.35	1.35 - 1.40	1.30 - 1.40
Salicylic acid, tech., bbl.	lb.	.30 - .32	.30 - .32	.32 - .33
Solvent naphtha, w.w., tanks	gal.	.35 -.....	.35 -.....	.35 -.....
Tolidine, bbl.	lb.	.95 - .95	.95 - .96	.90 - .95
Toluene, tanks, works	gal.	.35 -.....	.35 -.....	.35 -.....
Xylene, com., tanks	gal.	.36 - .41	.36 - .41	.36 - .40

Miscellaneous

		Current Price	Last Month	Last Year
Barytes, grd., white, bbl.	ton	$23.00-$25.00	$23.00-$25.00	$23.00-$25.00
Casein, tech., bbl.	lb.	.17½- .18	.17 - .18	.16 - .17
China clay, dom., f.o.b. mine	ton	10.00 -20.00	10.00 -20.00	10.00 -20.00
Dry colors:				
Carbon gas, black (wks.)	lb.	.06½- .07	.06½- .07	.08 - .08½
Prussian blue, bbl.	lb.	.33 - .34	.33 - .34	.32 - .33
Ultramine blue, bbl.	lb.	.08 - .35	.08 - .35	.08 - .35
Chrome green, bbl.	lb.	.27 - .31	.27 - .30	.28 - .30
Carmine red, tins	lb.	5.50 - 5.75	5.50 - 5.75	5.10 - 5.85
Para toner	lb.	.80 - .90	.80 - .90	.90 - .95
Vermilion, English, bbl.	lb.	1.80 - 1.85	1.80 - 1.85	1.45 - 1.50
Chrome yellow, C. P., bbl.	lb.	.17 - .18	.17 - .18	.17½- .18
Feldspar, No. 1 (f.o.b. N. C.)	ton	5.75 - 7.00	5.75 - 7.00	6.00 - 6.50
Graphite, Ceylon, lump, bbl.	lb.	.07½- .08	.07½- .09½	.09 - .10
Gum copal, Congo, bags	lb.	.09½- .10	.09½- .10	.09½- .10
Manila, bags	lb.	.15 - .18	.15 - .16	.14 - .10
Damar, Batavia, cases	lb.	.25 - .25½	.25 - .26	.25 - .25
Kauri, No. 1 cases	lb.	.55 - .57	.55 - .57	.58 - .62
Kieselguhr (f.o.b. N. Y.)	ton	50.00 -55.00	50.00 -55.00	50.00 -55.00
Magnesite, calc.	ton	44.00 -.....	44.00 -.....	38.00 -42.00
Pumice stone, lump, bbl.	lb.	.05 - .07	.05 - .08	.04½- .06
Imported, casks	lb.	.03 - .40	.03 - .40	.03 - .35
Rosin, H.	bbl.	8.00 -.....	8.35 -.....	13.50 -.....
Turpentine	gal.	.56 -.....	.49½-.....	.87 -.....
Shellac, orange, fine, bags	lb.	.59 - .61	.52 - .53	.48 - .50
Bleached, bonedry, bags	lb.	.62 - .65	.55 - .58	.52 - .54
T. N. bags	lb.	.55 - .56	.48 - .49	.43 - .44
Soapstone (f.o.b. Vt.), bags	ton	10.00 -12.00	10.00 -12.00	9.00 -11.00
Talc, 200 mesh (f.o.b. Vt.)	ton	10.50 -	10.50 -	10.50 -
200 mesh (f.o.b. Ga.)	ton	7.50 -10.00	7.50 -10.00	7.50 -11.00
325 mesh (f.o.b. N. Y.)	ton	13.75 -.....	13.75 -.....	14.75 -.....
Wax, Bayberry, bbl.	lb.	$0.22 -$0.26	$0.22 -$0.26	$0.20 -$0.21
Beeswax, ref., light	lb.	.43 - .45	.43 - .47	.46 - .47
Candelilla, bags	lb.	.27 - .28	.27 - .28	.36 - .37
Carnauba, No. 1, bags	lb.	.62 - .62	.62 - .62	.62 - .62
Paraffine, crude 105-110 m.p.	lb.	.05½- .06	.05½- .06	.05½- .06

Ferro-Alloys

		Current Price	Last Month	Last Year
Ferrotitanium, 15-18%	ton	$200.00-.....	$200.00-.....	$200.00-.....
Ferrochromium, 1-2%	lb.	.23- .25	.23- .35	.23- .....
Ferromanganese, 78-82%	ton	90.00-.....	90.00-.....	88.00-90.00
Spiegeleisen, 19-21%	ton	33.00-35.00	33.00-35.00	33.00-34.00
Ferrosilicon, 10-12%	ton	33.00-38.00	33.00-38.00	33.00-38.00
Ferrotungsten, 70-80%	lb.	.95- 1.00	.95- 1.00	1.05- 1.10
Ferro-uranium, 35-50%	lb.	4.50-.....	4.50-.....	4.50-.....
Ferrovanadium, 30-40%	lb.	3.15- 3.75	3.15- 4.00	3.25- 3.75

Non-Ferrous Metals

		Current Price	Last Month	Last Year
Copper, electrolytic	lb.	$0.13½-.....	$0.13½ -.....	$0.14½-.....
Aluminum, 96-99%	lb.	.25 - .26	.26 - .27	.27 - .28
Antimony, Chin. and Jap.	lb.	.11 - .12½	.12 - .12½	.15½- .16
Nickel, 99%	lb.	.35 -.....	.35 -.....	.35 -.....
Monel metal, blocks	lb.	.32 - .33	.32 - .33	.32 - .33
Tin, 5-ton lots, Straits	lb.	.58½-.....	.56½-.....	.64½-.....
Lead, New York, spot	lb.	6.50 -.....	6.25 -.....	8.40 -.....
Zinc, New York, spot	lb.	6.15 -.....	5.95 -.....	7.65 -.....
Silver, commercial	oz.	.57½-.....	.57½-.....	.63½-.....
Cadmium	lb.	.60 -	.60 -	.60 -
Bismuth, ton lots	lb.	1.85 - 2.10	1.85 - 2.00	2.70 - 2.75
Cobalt	lb.	2.50 -.....	2.50 -.....	3.00
Magnesium, ingots, 99%	lb.	.75 - .80	.75 - .80	.75 - .80
Platinum, ref.	oz.	66.00-	72.00-	111.00-
Palladium, ref.	oz.	52.00- 53.00	53.00- 54.00	69.00-71.00
Mercury, flask	75 lb.	128.00-.....	127.00-	99.50-.....
Tungsten powder	lb.	1.05- 1.15	1.05-	1.10-.....

Ores and Semi-finished Products

		Current Price	Last Month	Last Year
Bauxite, crushed, wks.	ton	$5.50- $8.50	$5.50- $8.50	$5.50- $8.75
Chrome ore, c.f. post	ton	22.00- 24.00	22.00- 24.00	22.00- 23.00
Coke, fdry., f.o.b. ovens	ton	3.75- 4.25	3.75- 4.25	3.75- 4.25
Fluorspar, gravel, f.o.b. Ill.	ton	17.00- 18.00	17.00-.....	18.00-.....
Ilmenite, 52% TiO_2, Va.	lb.	.00½ .00½	.00½ .00½	.01½-.....
Manganese ore, 50% Mn., c.i.f. Atlantic Ports	unit	.36 - 38	.36 - .38	.40 - .42
Molybdenite, 85% MoS_2 per lb. MoS_2, N. Y.	lb.	.48 - .50	.48 - .50	65- .70
Monazite, 6% of ThO_2	ton	120.00-.....	120.00-.....	120.00-.....
Pyrites, Span. fines, c.i.f.	unit	.13½-	.13½-.....	.13½-.....
Rutile, 94-96% TiO_2	lb.	.11 - .13	.11 - .13	.12 - .15
Tungsten, scheelite, 60% WO_3 and over	unit	10.35 -10.60	11.25 -11.50	12.50 -13.00
Vanadium ore, per lb. V_2O_5	lb.	.25 - .28	.25 - .30	.30 - .35
Zircon, 99%	lb.	.03 -.....	.03 -.....	.03 -.....

CURRENT INDUSTRIAL DEVELOPMENTS

New Construction and Machinery Requirements

Aluminum Foundry—Advance Pattern & Foundry Co., 2734 West 36th Pl., Chicago, Ill., will soon award contract for a 1 and 2 story, 125 x 365 ft. aluminum foundry at 36th Pl. and California Ave. Estimated cost $125,000. A. A. Wickland & Co., 5 South Wabash Ave., Chicago, Ill., are engineers.

Ammonia Plant—National Ammonia Co., 3600 North Broadway, St. Louis, Mo., awarded contract for a 1 story, 76 x 150 ft. addition to ammonia plant at 1 Destrehan St., to A. H. Haeseler Building & Construction Co., 620 Wainwright Bldg., St. Louis, Mo. Estimated cost $40,000.

Barium Sulphate Plant — The Sudbury Basin Co., Port Arthur, Ont., has acquired barium sulphate deposits at Javis Island, about forty miles from Port Arthur, Ont. and plans the construction of a plant. The material is to be used in conjunction with zinc for the manufacture of lithophone. Estimated cost $100,000.

Brewery — Hofer Brewing Co., Royal Bank Bldg., Windsor, Ont., awarded contract for a 4 story, 90 x 160 ft. brewery at La Salle, Ont., to Gosselin Construction Co., 120 Partington Ave., Sandwich, Ont. Estimated cost $150,000.

Brick and Tile Plant Equipment—American Brick Co. Inc., Nassar Bldg., McAllen, Tex., prices and catalogs on complete equipment including power shovel, gasoline driven, oil storage tank, etc. for proposed brick and tile plant at Rio Grande, Tex. Estimated cost $75,000.

Candy Factory—Schutter-Johnson Candy Co., 20 North Jefferson St., Chicago, Ill., is receiving bids for a 3 and 4 story, 38 x 300 ft. candy factory at Augusta and Cicero Aves. Estimated cost $300,000. A. Epstein, 2001 West Pershing Rd., Chicago, Ill., is architect.

Carbon Dioxide Plant — Dry Ice Co. of America, 50 East 42nd St., New York, N. Y., plans the construction of a plant for the manufacture of solid carbon-dioxide to replace water ice for refrigeration at Elizabeth, N. J. Estimated cost including equipment. $300,000. Pumps, blowers, tanks, etc. will be required.

Cement Plant—California Cement Assn., c/o Chamber of Commerce, Port Aransas, Tex., has acquired a site and plans the construction of a cement plant. Estimated cost $2,500,000.

Cement Plant—Carney Cement Co., Mankato, Minn., is having plans prepared for a 2 story, 40 x 130 ft. cement plant. Estimated cost $125,000. G. Pass & Son, Mankato, Minn., are architects.

Cement Plant—Pacific Coast Co., L. C. Smith Bldg., Seattle, Wash., will build a cement plant, 1,000,000 bbls. annual capacity. Estimated cost $3,000,000.

Cement Plant Addition—Canada Cement Co. Ltd., Phillips Sq., Montreal, Que., plans addition to cement plant at Winnepeg, Man. Estimated cost $500,000. Equipment will be required.

Cement Products Plant — Semloh Construction Co., Kings Highway, Brooklyn, N. Y., plans the construction of a cement products plant at 69th St. and Ave. Y. Estimated cost to exceed $40,000. Architect not selected.

Chemical Plant — Charles Lennig Co. Inc., Richmond and Kennedy Sts., Philadelphia, Pa., awarded contract for a 1 and 3 story, 45 x 91 ft. chemical plant to A. R. Raff, 1635 Thompson St., Philadelphia, Pa.

Chemical Plant — Neville Chemical Co., Neville Island, Pittsburgh, Pa., awarded contract for a 1 story chemical plant to The Austin Co., Union Trust Bldg., Pittsburgh, Pa. Estimated cost $50,000.

Chemical Plant—Oelwein Chemical Co., E. Rhine, Mgr., Oelwein, Ia., is having revised plans prepared for a 4 story, chemical plant. Estimated cost $45,000. R. F. Moore, 1111-13 Merchants National Bank Bldg., Cedar Rapids, Ia., is architect.

Chemical Factory—Sand Springs Chemical Co., Sand Springs, Okla., c/o O. V. Martin and W. H. Colvin, Jr., 39 South La Salle St., Chicago, Ill., is having surveys made for the construction of a factory for reclamation of various chemicals from oil brines. Estimated cost $600,000. Equipment will be required.

Chemical Plant — Smith Agricultural Chemical Co., 1850 Kentucky Ave., Indianapolis, Ind., will build a chemical plant. Estimated cost $40,000. Private plans.

Chemical Factory—E. R. Squibb & Sons, 80 Beekman St., New York, N. Y., will soon award contract for a 12 story, 98 x 164 ft. chemical factory at Columbia Heights and Doughty St. Estimated cost $500,000. R. G. Carey, 30 Church St., New York, N. Y., is architect.

Chemical Plant—Tacoma Electrochemical Co., Wilmington, Del., c/o Pennsylvania Salt Mfg. Co., Widener Bldg., Philadelphia, Pa., had preliminary plans prepared for the construction of a plant for the manufacture of liquid chlorine and caustic soda, etc. at Tacoma, Wash.

Chemical Plant—Western Industries Co., 110 Sutter St., San Francisco, Calif., had plans prepared for a 5 story plant for the manufacture of acetic acid, wood alcohol and charcoal at Stege, Calif. Estimated cost $250,000. Private plans.

Chemical Products Plant—E. I. duPont de Nemours, Hamilton Ave., Flint, Mich., awarded contract for a 2 story, 45 x 85 ft. chemical products plant on St. John St. to W. E. Wood Co., 1805 Ford Bldg., Detroit, Mich. Estimated cost $50,000.

Chemical Process Plant—Grasselli Chemical Co., Guardian Bldg., Cleveland, O., awarded contract for a 1 story, 65 x 126 ft. chemical process plant on Independence Rd. to Forest City Structural Steel Co., West 110th St., Cleveland, O. Estimated cost $60,000.

Chemistry Building—Bd. of Trustees, Ohio State University, C. E. Steele, Secy., Columbus, O., is having plans prepared for a 5 story, 84 x 150 ft. addition to chemistry building on Campus. Estimated cost $290,000. J. N. Bradford, c/o owner, is architect.

Chemistry Building—University of Indiana, W. L. Bryan, Pres., Bloomington, Ind., is having plans prepared for a 2 story chemistry building. Estimated cost $200,000. Daggett & Hibben, 922 Continental Bank Bldg., Indianapolis, Ind., are architects.

Coke Plant—Hamilton By-Product Coke Co., 15 Main St. E., Hamilton, Ont., awarded contract for the construction of a coke plant to Semet-Solvay Engineering Co., 40 Rector St., New York, N. Y. Estimated cost $400,000.

Compressed Gas Plant—Linde Air Products Co., 803 East 72nd St., Cleveland, O., plans the construction of a 1 story compressed gas plant at 13th St. N.E., Canton, O. Estimated cost $100,000.

Cresoting Plant—Republic Cresoting Co., 736 North Miami St., Indianapolis, Ind., awarded contract for the construction of a cresoting plant. Estimated cost $40,000.

Dyeing and Cleaning Plant—Star Dyeing & Cleaning Co., 2515 North Grand Blvd., St. Louis, Mo., awarded contract for a 2 story, 74 x 91 ft. dyeing and cleaning plant at 2515-21 North Grand Blvd. to Mississippi Valley Construction Co., 801 Chestnut St., St. Louis, Mo. Estimated cost $60,000.

Enameling Plant—Chrysler Corp., 341 Massachusetts Ave., Detroit, Mich., plans the construction of a 1 and 2 story, 60 x 400 ft. enameling plant for automobile factory on East Jefferson Ave. Enameling tanks and handling equipment will be required.

Feldspar Plant—C. B. Hyatt, Asheville, N. C. and other North Carolina and New York interests, plan the construction of a feldspar plant for mining and milling feldspar on Black Mountain Ry. at Bowditch, near Burnesville, N. C. Estimated cost $500,000. J. L. Hyatt, Burnesville, N. C. and J. F. Shinn, Norwood, N. C., are also interested.

Fig Preserving Plant—Tyrell-Garth Bros., Elena, Tex., plans the erection and equipping of fig preserving plant. Estimated cost $18,000.

Fig Preserving and Products Plant—F. H. & H. F. Thaman & Associates, Atla Loma, Tex., recently organized, plans the construction of a fig preserving and products plant. Estimated cost including equipment $50,000.

Fig Products Plant—Magnolia Fig Products Co., c/o T. C. Edwards, Alvin, Tex., plans extensions and improvements to fig products plant to increase capacity. Estimated cost $100,000. Machinery and equipment will be required.

Gas Compressing Plant, Gas Tank, Etc.—C. E. Evans, City Comr. with supervision of Duluth Water & Light Dept., Duluth, Minn., plans a $500,000 program to include erection of 3,000,000 cu.ft. gas tank, and gas compressing plant for 1928, $340,000, also 1,000,000 cu.ft. gas holder, etc. in eastern section of city for 1931, $140,000. Engineering forces of Duluth Water & Light Dept. will prepare plans.

Galvanizing Works — Thomas Gregory Galvanizing Works, 263 North Henry St., Long Island City, N. Y., awarded contract for the construction of galvanizing works at Grand Ave. and 149th St. to The Austin Co., 120 Broadway, New York, N. Y. Estimated cost $60,000.

Glass Factory—Pittsburgh Plate Glass Co., Frick Bldg., Pittsburgh, Pa., plans the construction of a glass factory at Los Angeles, Calif. Estimated cost $40,000. Architect and engineer not selected.

Laboratory—Antioch College, A. E. Morgan, Pres., Yellow Springs, O., plans the construction of a laboratory. Estimated cost $300,000. Architect not selected.

Laboratory—Combustion Utilities Corp., 60 Wall St., New York, N. Y., awarded contract for the construction of a 1 story, 50 x 125 ft. laboratory at Linden, N. J. to The Austin Co., 120 Broadway, New York, N. Y. Estimated cost $40,000.

Laboratory — The Keyes Fibre Co., Waterville, Me., awarded contract for a 2 story, 86 x 156 ft. laboratory to Morton C. Tuttle Co., 862 Park Sq. Bldg., Boston, Mass.

Laboratory—Mottu & White, 527 North Charles, Baltimore, Md., Archts., will receive bids about Dec. 12 for a 3 story laboratory at 1023 North Charles St. for Hynson, Westcott, Dunning, Eutaw Pl. and North Ave., Baltimore, Md. Estimated cost $60,000.

Laboratory—State of Connecticut, F. L. Salmon, State Comptroller, State House, Hartford, Conn., awarded contract for a 3 story, 60 x 110 and 60 x 220 ft. laboratory at Storrs, Conn. for Connecticut Agricultural College to Charles Smith & Sons, Inc. 254 Main St., Derby, Conn. Estimated cost $354,000.

Laboratory Equipment—Evansville College, R. E. Robb, Prof. of Civil Engineering, Evansville, Ind., prices and catalogs on complete equipment for proposed testing laboratory.

Laboratory, Etc.—Bureau of Yards & Docks, Navy Dept., Washington D. C., will receive bids until January 18, for the construction of a laboratory at Naval Operating Base, Pearl Harbor, T. H.

Laboratory (Pathological)—The University Hospitals, Assn., F. A. Scott, Pres., c/o Warner & Swasey Co., 5701 Carnegie Ave., Cleveland, O., will soon award contract for a 5 story, 57 x 160 ft. pathological laboratory on Adelbert Rd. Estimated cost $750,000. A. Garfield, National City Bldg., Cleveland, O., is architect.

Laboratories — University of Tennessee, Knoxville, Tenn., awarded contract for a 2 story science hall including laboratories, etc. at Martin, Tenn. to N. B. Williams, Martin, Tenn., also had plans prepared for a group of college buildings including laboratories, at Union and Madison Entrances, Memphis, Tenn. Estimated cost $69,653 and $400,000 respectively. Jones & Furbringer, Porter Bldg., Memphis, Tenn., are architects.

Lignite By-Products Plant—Texas Natural Resources Corp., c/o W. Clifford, 565 Fifth Ave., New York, N. Y., has acquired more than 5,000 acres in Panola county near Marshall, Tex., as a site for a plant for

the manufacture of lignite by-products, coke specialties, etc. Estimated cost including equipment $1,000,000.

Lime Plant—Diamond Springs Lime Co., c/o H. C. Smith, Humboldt Bank Bldg., San Francisco, Calif., Archt., is having plans prepared for the construction of a lime plant at Diamond Springs, Calif. Estimated cost $400,000.

Magnesia Factory—Norristown Magnesia & Asbestos Co., Norristown, Pa., plans the construction of a 1 story, 115 x 280 ft. factory and warehouse. Estimated cost $100,000. Private plans.

Milk Powder, Etc.—Dairy Corp., c/o M. Turnet, Chn., Marshall, Tex., having preliminary plans prepared for a factory for the manufacture of butter, buttermilk powder and skim milk powder, 80,000 lb. milk daily capacity. Estimated cost including equipment $125,000. F. H. Douthitt Engineering Co., 139 North Clark St., Chicago, Ill., is engineer.

Milk Products Plant—Shelbyville Milk Products Co., Shelbyville, Ind., awarded contract for a 4 story, 50 x 160 ft. milk products plant to H. O. Phares, Shelbyville, Ind. Estimated cost $40,000.

Oil Blending Plant—Forbush Fuel & Ice Co., 100 North Grand Ave., Pueblo, Colo., will build a 2 story, 30 x 40 ft. oil blending plant. Estimated cost $43,000. Architect and engineer not selected. Tanks, blending kettles, etc. will be required.

Oil Products Plant—American Oil Products Co., 230 Milk St., Boston, Mass., had plans prepared for a 1 story, 55 x 135 ft. addition to oil products plant on Washington St., Somerville, Mass. Monks & Johnson, 99 Chauncy St., Boston, are engineers.

Paint, Enamel, Calcium Chloride, Etc.—State Highway Commission, Ames, Ia., will receive bids until Dec. 27 for rail paint, bridge paint, equipment enamel, paving center line marking paint, calcium chloride, etc.

Paint Factory Addition—J. B. Sipe Co., Bridgeville, Pa., awarded contract for a 1 story, 50 x 82 ft. addition to paint factory to The Austin Co., Union Trust Bldg., Pittsburgh, Pa. Estimated cost $40,000.

Paint and Varnish Factory Addition—Devoe & Raynolds, 825 West Chicago Ave., Chicago, Ill., awarded contract for a 4 story, 75 x 75 ft. addition to paint and varnish factory to Jacob Rodatz, 209 South La Salle St., Chicago, Ill.

Paperboard Mill — Canadian Paperboard Co., H. O. 2 Leigneurs St., Montreal, Que., awarded contract for a paperboard mill including a 2 story, 85 x 88 ft. beater building, 1 story, 100 x 108 ft. finishing room, etc. at Toronto, Ont. to W. J. Trimble, 73 Adelaide St. W., Toronto, Ont. Estimated cost $1,000,000. Breaker beater, pumps, motors, etc. will be required.

Paper Plant Addition — Consolidated Paper Co., Monroe, Mich., plans the construction of a 3 story, 200 x 700 ft. addition to paper plant on First St. Estimated cost $500,000. Private plans.

Patent Leather Factory—E. H. Merrill, Winchester, Mass. and H. P. Peterson, Woburn, Mass., will build a 2 story patent leather factory at North Woburn, Mass. Estimated cost $100,000. Private plans. Work will be done by separate contracts.

Porcelain Plant—National Porcelain Enameling & Foundry Co., 718 Farhill Ave., Dayton, O., awarded contract for a 1 story, 56 x 160 ft. porcelain plant on Freeland Ave., Detroit, Mich. to Cooper-Little Co., 844 Macabees Bldg., Dertoit, Mich. Estimated cost $50,000.

Refinery (Oil)—Shell Union Oil Corp., 65 Broadway, New York, N. Y. has acquired a site and plans the construction of an oil refinery at Port Arthur, Tex. Private plans.

Refinery (Oil and Gasoline) — Dixon Creek Oil Co., Borger, Tex., plans to rebuild oil and gasoline refinery recently destroyed by fire. Estimated cost $150,000. Private plans. Machinery and equipment will be required.

Refractory Plant—Harbison-Walker Refractories, J. E. Lewis, Pres., Pittsburgh, Pa., plans the construction of a refractory plant at Patapsco Ave. and 9th St., Baltimore, Md. Estimated cost $1,000,000. Architect and engineer not selected.

Rubber Factory — Manhattan Rubber Mfg. Co., Willett St., Passaic N. J., will build a 1 story, 50 x 120 ft. rubber factory on Van Houten Ave. Estimated cost $40,000. Private plans.

Rubber Factory—Panco Rubber Co., 31 Highland St., Chelsea, Mass., had plans prepared for a 1 story, 90 x 100 ft. addition to rubber factory. Schein & Levine, 448 Broadway, Chelsea, Mass., are architects.

Rubber Factory—Puritan Rubber Co., J. Flynn, Mgr., Ft. Perrine Ave., Trenton, N. J., will soon receive bids for a 1 story rubber factory. Estimated cost $30,000. L. S. Kaplan, Montgomery and Hanover Sts., are architects.

Rubber Factory—Weartex Rubber Co., S. Schwaber, Pres., Trenton, N. J., plans the construction of a 2 story plant for the manufacture of rubber heels, soles, etc. at 3210-22 Philadelphia Ave., Baltimore, Md.

Rubber Factory Addition—Goodyear Tire & Rubber Co., New Toronto, Ont., will soon award contract for the construction of a 4 story, 100 x 125 ft. addition to rubber factory at Lake Shore Rd. Estimated cost $175,000. Private plans.

Smelter—Flin Flon Mining Co., Mining Corp. of Canada, Winnipeg, Man., plans the construction of a smelter capable of treating 3,000 ton of ore per day, also water power development, ultimately producing 270,000 hp.

Soap Factory—A. B. Wrisley Co., 529 South Franklin St., Chicago, Ill., awarded contract for the construction of a 1 story, 120 x 250 ft. soap factory at West 65th St. and Oak Park Ave. to Foltz & Co., 510 North Dearborn St., Chicago, Ill.

Soap and Soda—Depot Quartermaster, Marine Corp., Philadelphia, Pa., will receive bids until Dec. 21 for 36,000 lbs. of caustic soda, 500 lbs. automobile soap, 2,400 lbs. castile soap, 5,000 cans mechanical hand soap, 5,000 lbs. grit soap, 1,600 lbs. white floating soap and 10,000 lbs. laundry soap. Schedule 297.

Soda Ash—City of Oklahoma City, Okla., is in the market for one carload of soda ash for water department.

Sugar Mill—Southern Sugar Co., B. G. Dahlberg, Chicago, Ill., Pres., has work under way on the construction of first unit of 6,000 ton sugar mill at Clewiston, Fla.

Sulphate of Alumina, Portland Cement, Etc.—City of Minneapolis, Minn., will receive bids about Jan. 1 for about 3,000 tons of sulphate of alumina, for filter plant.

Tannery—Bay State Leather & Tanning Co., Haverhill, Mass., awarded contract for a 1 story, 60 x 270 ft. tannery on Cross St., Woburn, Mass. to D. McLaughlin & Son, 35 Hudson St., Woburn, Mass.

White Lead—Quartermaster Corps, Miller Field, Staten Island, N. Y., will receive bids until Dec. 15 for 2,000 lbs. white lead. Circular 23.

Yeast Factory—Northwestern Yeast Co., 1750 North Ashland Ave., Chicago, Ill., will soon award contract for a 2 and 7 story, 100 x 173 ft. yeast factory. Zimmerman, Saxe & Zimmerman, 212 East Superior St., Chicago, Ill., are architects.

INDUSTRIAL NOTES

THE STATEN ISLAND SHIPBUILDING COMPANY, which for more than a quarter of a century has been active in building commercial ships on the Atlantic Coast, has formed a division for the manufacture of heat transfer apparatus to be known as Heat Transfer Products, Inc. These products are not a new line with the company, as this type of equipment has been manufactured at the plant for more than thirty years. The line consists of equipment including water storage heaters, feed water heaters, bleeder heaters, waste heat extractors, preheaters, condensers, evaporators, brine coolers, oil heaters, oil coolers, humidifiers, tanks, piping, including bends of all materials, pumps, fabricated plate ware and galvanized products. The personnel of Heat Transfer Products, Inc., consists of William J. Davidson, chairman of the board, George T. Jacocks, president and general manager, Sylvan J. Crooker, vice-president in charge of engineering, Walter S. Ogilvy, vice-president in charge of manufacture and secretary and George H. Bates as treasurer. The main plant of the company is located at Mariners Harbor, Staten Island, N. Y.

HERBERT R. ISENBURGER, INC., successor to Bondi & Isenburger, Inc., 63 Park Row, New York, has established an industrial X-ray service for research and analysis of materials, with Dr. Ancel St. John supervising all laboratory investigations.

THE W. B. CONNOR CO., INC., New York, has acquired the rights, patents and interests in the Shortt pumping trap from the Stebbins Engineering and Manufacturing Company.

THE COCHRANE CORPORATION announces the appointment of Cochrane Sales Company, Inc., Room 1478, 50 Church Street, New York, N. Y., as its representative for the sale of Cochrane equipment, succeeding F. E. Idel, deceased.

THE COOPER HEWITT ELECTRIC COMPANY opened its new office and factory building at 410 Eighth Street, Hoboken, N. J., December 8, on its twenty-fifth anniversary.

HAZARD WIRE ROPE COMPANY, Wilkes-Barre, Pa., has acquired the wire rope division of the Waterbury Company in New York.

THE TACOMA ELECTROCHEMICAL COMPANY, Tacoma, Wash., was organized at Wilmington, Del., in November for the purpose of building and operating a chemical plant to produce liquid chlorine and caustic soda. Other products will be manufactured later. The Pennsylvania Salt Manufacturing Company of Philadelphia holds all of the capital stock and will provide funds for construction and operation. It is expected that the plant will be in operation in the Spring of 1928.

THE GILBY WIRE COMPANY has moved to its new plant on Riverside Ave., Newark, N. J.

MITSUI AND COMPANY, LTD., has moved its uptown office to 180 Madison Ave., New York City.

THE PITTSBURGH VALVE, FOUNDRY AND CONSTRUCTION COMPANY announces the addition of Robert Whyte to its sales staff.

THE STOCKHAM PIPE AND FITTINGS COMPANY, Birmingham, Ala., announces the reorganization of its executive personnel as follows: Douglas W. Stockham, vice-president in charge of sales; Roy L. Stewart, manager of Sales; Harry N. Hall, advertising and sales promotion manager; Germer Petesch, manager of the Chicago warehouse; H. G. Farnum, manager of the Boston warehouse and Irving Lyon, manager of the steel sales promotion department. With the exception of Mr. Petesch and Mr. Farnum, all of the above mentioned are at Birmingham.

THE NIAGARA BLOWER COMPANY, Buffalo, N. Y., announces the appointment of Henry E. Jacoby, 95 Liberty St., New York, as its Eastern sales representative.

THE NATIONAL MAGNESIA MANUFACTURING COMPANY announces the removal of its general offices to its factory at Redwood City, Calif.

THE BAILEY METER COMPANY announces the removal of its main offices and works to its new plant at 1050 Ivanhoe Road, Cleveland, Ohio.

THE GENERAL CERAMICS COMPANY, New York, announces the opening of a district sales office at 208 So. LaSalle Street, Chicago, in charge of Robert S. Beecher.

F. J. RYAN AND COMPANY, at the last directors' meeting changed the company's name to Ryan, Scully & Company. The changed name does not mean a change in the policies, control or financial position of the organization, but is purely an indication of the active participation that is being taken in the company's affairs by A. C. Scully.

The Security Grating Department of the BLAW-KNOX COMPANY announces the appointment of the following distributors for Blaw-Knox security open flooring, electroforged grating and steps: Worden-Allen Company, Milwaukee, Wis.; Wilson-Weesner-Wilkinson Company, Knoxville, Tenn., and Jas. A. Hall, 1525 Esperson Bldg., Houston, Texas.

THE STRUTHERS-WELLS COMPANY, Warren, Pa., has appointed H. W. How as consulting engineer.

Pipe joint engineering — not a profession but a function★

POWER PLANT engineers are becoming more favorable in their attitude toward oxwelded headers. They realize that in the present day installations, where higher pressures and much higher temperature are the governing factors, they must find a type of joint that will eliminate all possible hazard from leaks or breaks. The oxwelded joint is now offering these desirable and necessary characteristics.

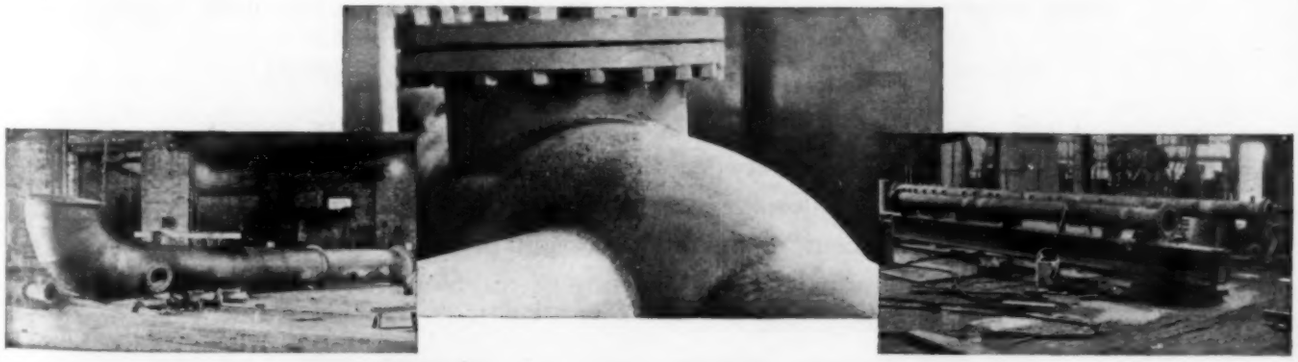
There are several obvious reasons for this. For instance, the first cost. Suppose we take as an example a ten-inch high-pressure header, thirty feet long, with six outlets varying from five to eight inches. With flanged joints and extra heavy cast steel fittings, such a header will cost approximately three times as much as a header having welded joints, welded outlets and a welded drip.

The maintenance of a joint is of still greater importance. Every engineer knows that flanged piping systems must be constantly tightened, that gaskets invariably develop leaks, and that expensive hand-moulded insulation must be replaced. The welded joint does not leak and requires no maintenance.

We have an interesting service report from an engineer in whose plant an oxwelded steam line has connected two main buildings for many years, who did not know that the line had oxwelded joints. It was installed sixteen years ago, before he took charge of the power plant, and in the intervening time has required no maintenance.

Since welded headers are proving so satisfactory, it is only logical that welded joints should be adopted throughout the entire power plant. Detailed information on the use of the oxy-acetylene process of welding and cutting in power plant piping under Linde Procedure Controls is available at Linde offices.

THE LINDE AIR PRODUCTS COMPANY
Unit of Union Carbide and Carbon Corporation
UCC
General Offices: Carbide and Carbon Building
30 East 42d Street, New York
37 PLANTS . . . . . 105 WAREHOUSES



LINDE OXYGEN

★No. 12 of a series of advertisements on the engineering phases of oxy-acetylene welding and cutting. Send for the booklet entitled: "Engineering and Management Phases of Oxwelded Construction."

LACQUER SOLVENTS

CELLOSOLVE

(Ethylene Glycol mono ethyl ether)

Boiling Point	134.8°C	Acidity	None
Boiling Range	Initial 128°C	Specific Gravity	0.927—0.933
	Dry Point 137°C	Weight per gallon	7.8
Dilution Ratio	6.25 volumes of Toluene (10% cotton solution)		

Cellosolve is the most powerful nitrocellulose solvent commercially available. Its lack of odor makes it particularly valuable in the manufacture of brushing lacquers, architectural lacquers and lacquers for natural or artificial leathers.

CELLOSOLVE ACETATE

(Ethylene Glycol mono ethyl ether acetate)

Boiling Point	154°C	Acidity	Not more than 0.01% (as acetic)
Boiling Range	Initial 140°C	Specific Gravity	0.973—0.982
	Dry Point 165°C	Weight per gallon	8.1
Dilution Ratio	2.6 volumes of Toluene (10% cotton solution)		

Cellosolve acetate is particularly valuable as a retarder and blush resister. It is being widely used in thinners for automobile base lacquers and in the manufacture of "mist coats."

BUTYL CELLOSOLVE

(Ethylene Glycol mono butyl ether)

Boiling Point	170.6°C	Acidity	None
Boiling Range	Initial 163°C	Specific Gravity	0.900—0.905
	Dry Point 174°C	Weight per gallon	7.6
Dilution Ratio	4.00 volumes of Toluene (10% cotton solution)		

Until now there has never been a good nitrocellulose solvent having a boiling range between the usual "high boilers" and the plasticizers. Butyl Cellosolve fills this gap. It is also an excellent gum and resin solvent. The incorporation of small quantities in lacquers insures gradual and even setting of the film with high gloss and absence of orange peel.

CARBIDE AND CARBON CHEMICALS CORPORATION

Carbide and Carbon Building

30 East Forty-second Street, New York City

UCC

Unit of Union Carbide and Carbon Corporation

BRASS VALVES for Power Lines . . . . Here they are

SEND FOR A COPY

The general "why's" and "wherefore's" of brass valve recommendations for Power Lines are clearly set forth in the Walworth Valve Book.

And, getting down to cases, this handy manual gives you all the details of the design, dimensions and prices of the Walworth line of High Grade Brass Valves from 125 lbs. to 350 lbs. pressure, at temperatures ranging as high as 600° F.

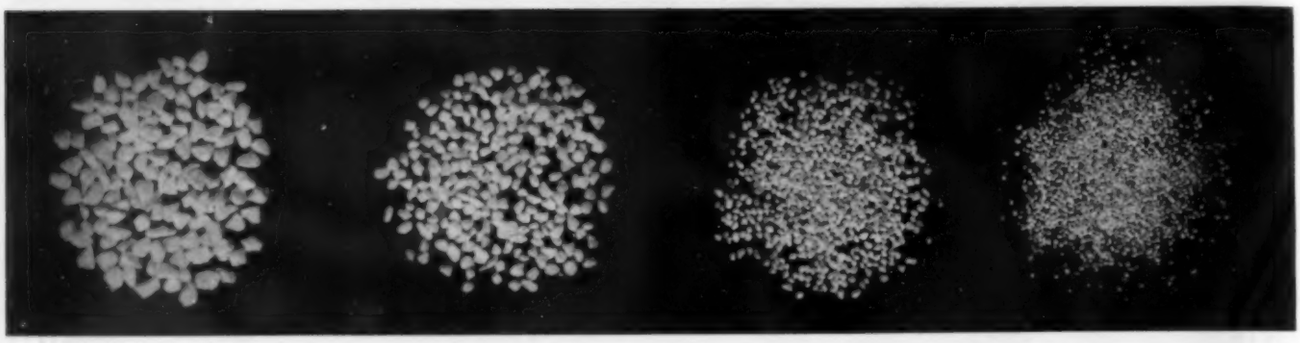
The leading Walworth valves for safe service on power lines are shown in colored cross-sections. The book also contains further data on all the valves that Walworth makes, including brass, iron, steel iron and Walworth Sigma Steel.

WALWORTH

Walworth Company, General Sales Offices: 51 East 42nd St., New York
Plants at Boston, Mass.; Kewanee, Ill.; Greensburg, Pa.; and Attalla, Ala.

Distributors in Principal Cities of the World

Walworth Co., Limited, 10 Cathcart St., Montreal, P. Q.
Walworth International Co., New York, Foreign Representative



Capacity Plus Accuracy

Capacity and Accuracy—qualities universally required in screening equipment—are natural characteristics of ROTEX operation.

These characteristics are the result of several outstanding and individual features of the ROTEX Screen—

The screen surface of the ROTEX Screen is nearly level, making possible the unusually accurate separations obtained.

The screen box has a horizontal gyratory motion which distributes and stratifies the material. This motion also has a conveying action which causes the material to pass over the screen fast enough to obtain large capacities.

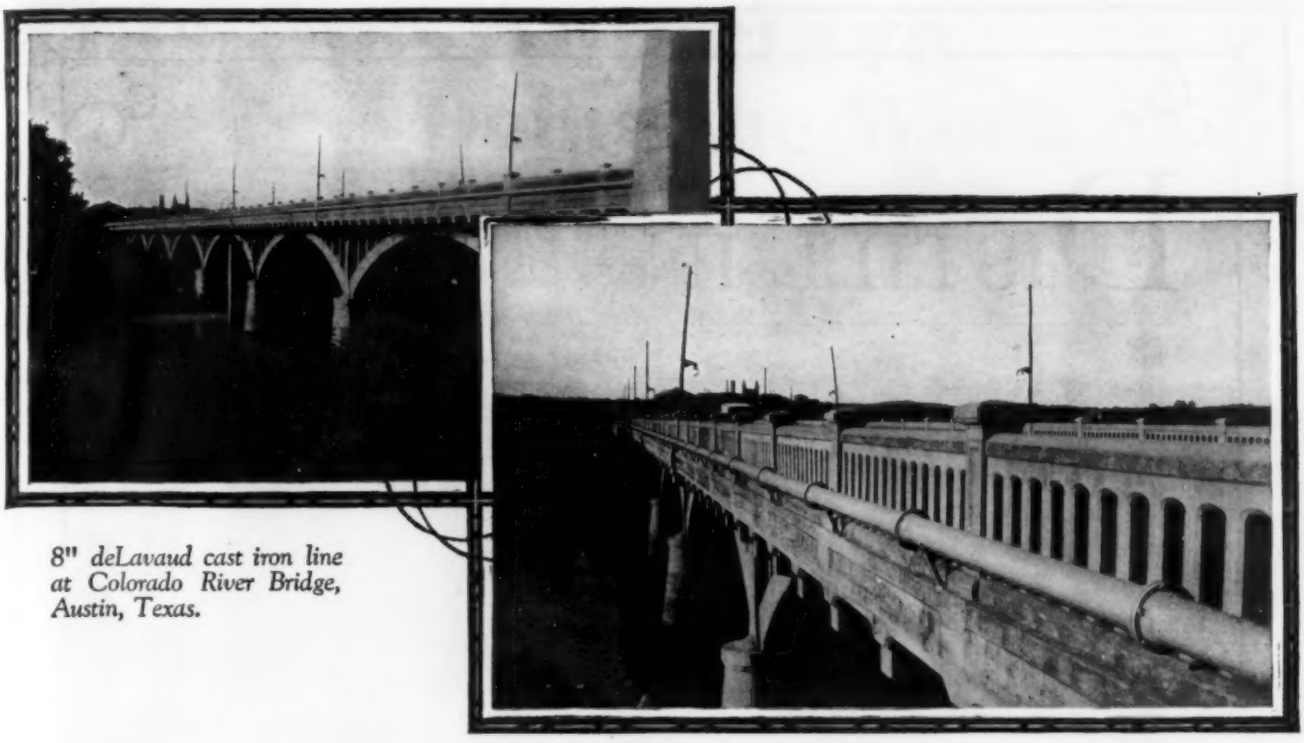
The solid rubber balls in the patented "ball-and-bevel-strip" mesh cleaning system, by striking the under side of the screen, set up a positive mesh cleaning action which is very effective because of the actual pounding contact of the balls against the screen and the uniform vibration produced.

In brief, the ROTEX Screen will give you large capacity with accuracy and, due to its rugged construction, will also operate economically.

Our Catalog No. 80 contains complete information.

ROTEX

The
ORVILLE SIMPSON COMPANY
Office and Factory
1252 KNOWLTON ST. CINCINNATI, OHIO

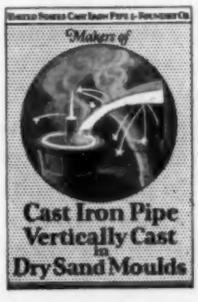


8" deLavaud cast iron line at Colorado River Bridge, Austin, Texas.

deLavaud Centrifugal Cast Iron Pipe with Anthony Joints makes a *permanently* tight line

SUCH installations as illustrated here are subject to unusual strains and constant vibration. The great tensile strength of deLavaud pipe and the flexibility of the Anthony Joint eliminates the possibility of these strains causing leakage.

Municipal, industrial or construction engineers should write for literature covering specifications, manufacture and use of deLavaud pipe for high pressure mains.



United States Cast Iron Pipe and Foundry Company

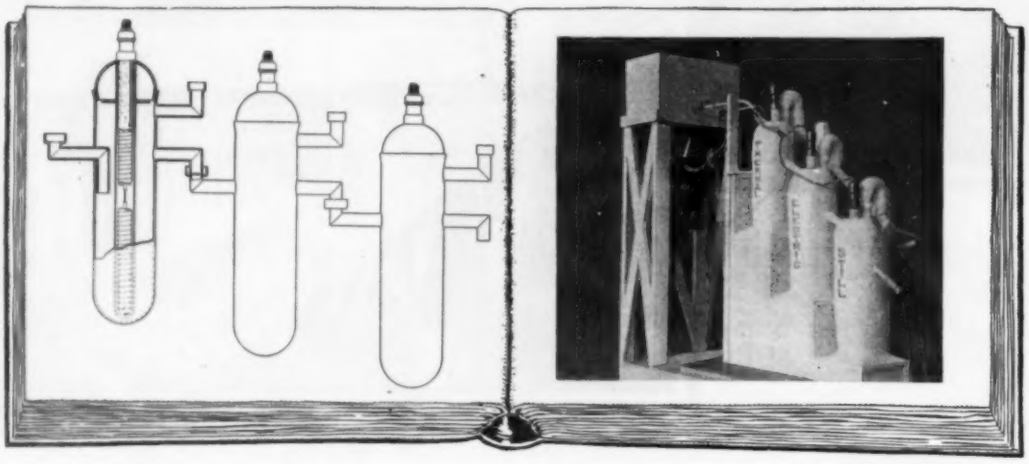
General Offices:
Burlington, New Jersey

SALES OFFICES

Philadelphia: 1421 Chestnut St.
Chicago: 122 So. Michigan Blvd.
Birmingham: 1st Ave. & 20th St.
Buffalo: 957 East Ferry Street
Cleveland: 1150 East 26th Street
New York: 71 Broadway
San Francisco: 3rd & Market Sts.
Pittsburgh: 6th & Smithfield Sts.
Dallas: Akard & Commerce Sts.
Kansas City: 13th & Locust Sts.
Minneapolis: 6th St. & Hennepin Ave.

DISTILL IN *Vitreosil*

Fused Pure Silica



THE Thermal Electric Still shown in the cuts is an highly efficient distillation unit. It is electrically heated, internally out of contact with the acid, and insulated on the outside to prevent heat losses. The distillate from the individual units may be collected separately, and the heat input per unit readily controlled.

The distillation unit is designed primarily for the distillation of C. P. sulphuric acid. It is equally suited to the distillation of nitric acid, water, or other liquids, especially where fractionation is required.

Additional noteworthy advantages are:

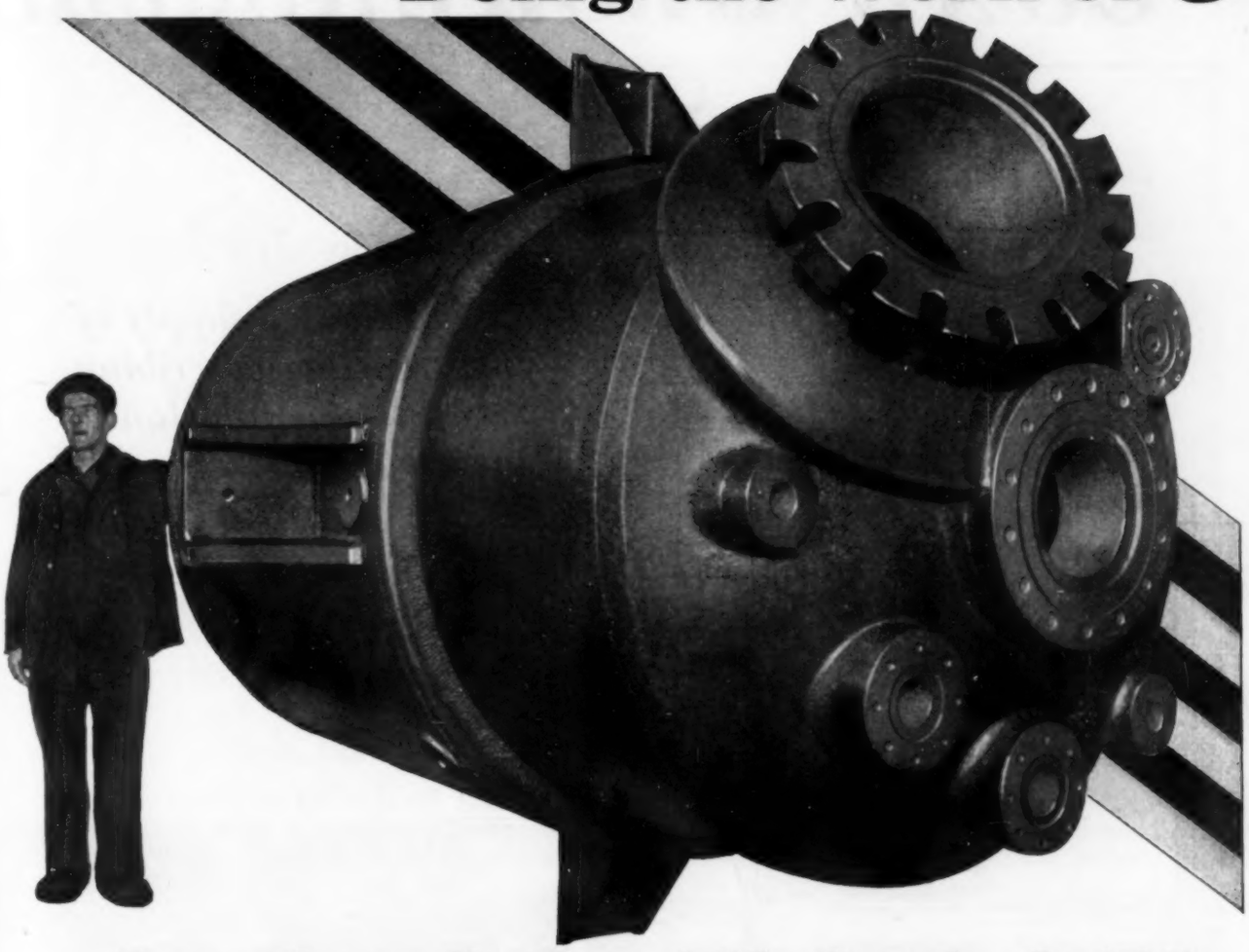
Made entirely of vitreosil (fused pure silica)
Non-breakable through temperature changes
Heating units easily renewed
Purity of product assured
Economy of floor space
Low maintenance cost
Requires no attention
Low operating cost
No packed joints
Accurate control
High efficiency
Easily cleaned

Write us regarding your distillation problem.

The THERMAL SYNDICATE *Ltd.*

64 Schenectady Avenue, Brooklyn, New York

This One Autoclave Doing the Work of 3

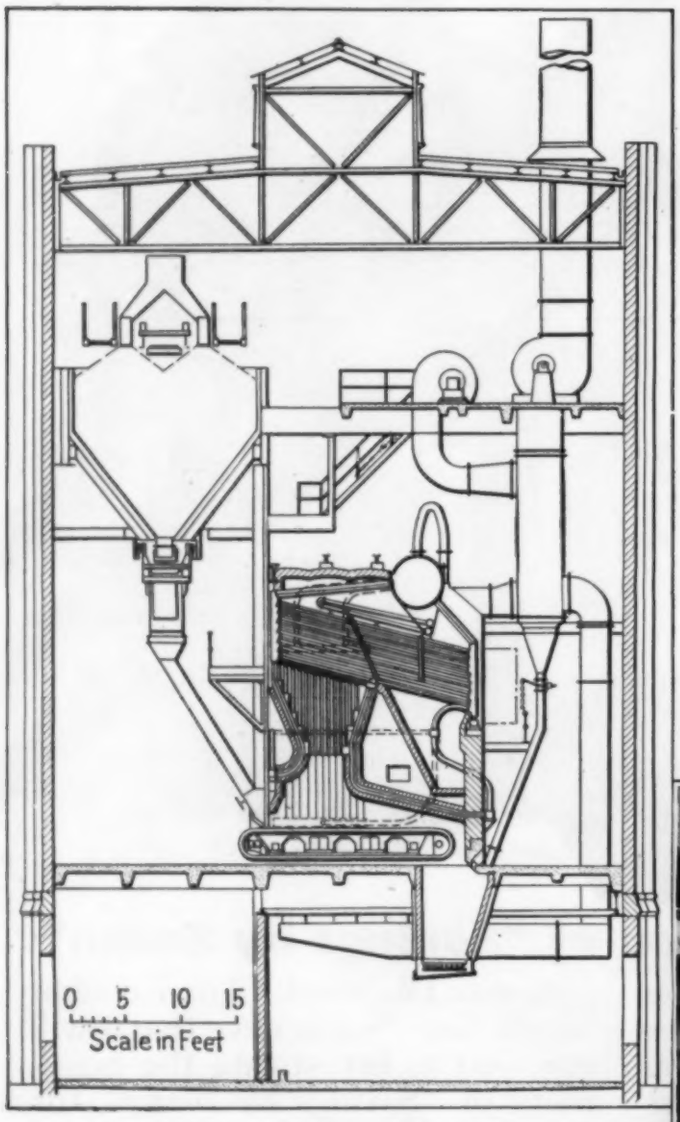


—shows the realization of "Savings by Smith"

This one Smithsteel Autoclave does the work of three autoclaves previously used in a plant of one of the largest chemical process corporations. It is 54″ inside diameter, 15′ long and 3″ thick. The jacket is 1⅞″ thick. Total weight 32,600 lbs. We believe that it will pay you to investigate the possibility of "Savings by Smith" for Pressure Vessels for any type of service.

A. O. SMITH CORPORATION : : *Milwaukee, Wisconsin*

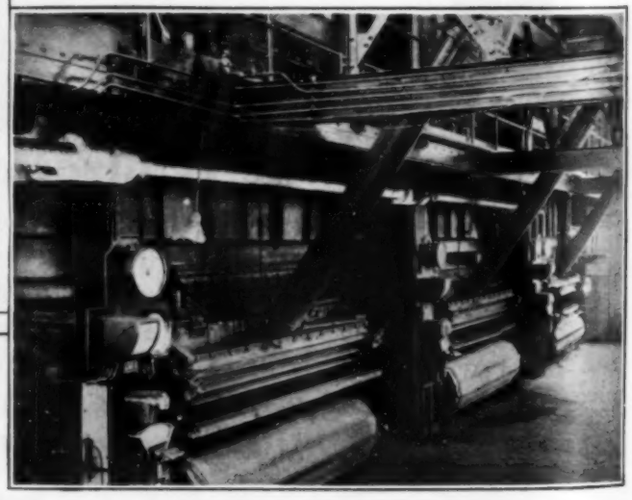
COXE STOKERS burn c



Cross section through the boiler room

A limited supply of reprints describing this installation is available.

A copy will be sent upon request.



View showing three Coxe Stoker units installed at Hunts Point

Combustion E
International Combustion Building Corpo

A SUBSIDIARY OF INTERNATIONAL CO

coke breeze at Hunts Point

AT the new Hunts Point by-product coke plant, New York, are installed three Coxe Stoker units representing the latest stoker and furnace design for burning waste fuels, such as coke breeze and anthracite fines.

C-E Fin Furnace tubes eliminate side wall maintenance and add effective steam generating surface.

C-E Air Preheaters utilize the heat ordinarily lost up the stack, for preheating the air entering the furnace.

Coxe Stokers are installed for burning waste fuels, under boilers totaling over 800,000 rated horse power.

INTERNATIONAL COMBUSTION ENGINEERING CORPORATION

- Lopulco Storage System (*Pulverized Fuel*
- Lopulco Unit System (*Pulverized Fuel*
- Raymond Pulverizing Mill
- C-E Fin Furnace
- C-E Air Preheater
- Frederick Multiple Retort Stoker
- Type E Stoker
- Type K Stoker
- Type H Stoker
- Coxe Stoker
- Green Natural Draft Stoker
- Green Forced Draft Stoker
- C-E Ash Conveyor
- Combustion Steam Generators
- Ladd Boilers
- Heine Boilers

Engineering

200 Madison Ave (35th to 36th St.) New York

COMBUSTION ENGINEERING CORPORATION

The Battle

EVERY manufacturer is fighting that battle in the field of industry today. And he has to fight hard, in order to survive the contest of competition, particularly in the production of raw materials and basic products.

This is not new phenomena. Study the economic history of this country following the Civil War. What happened?

Prices and costs went sky-high during the war. After it ended, prices and costs began to recede, and for *eleven years* they worked steadily and relentlessly downward.

Of course, the same thing occurs as the natural and inevitable result of every war. Any business man, who has looked behind the industrial scenes of the past decade, knows this to be a fact.

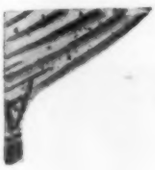
We are no prophets, and are not making predictions as to future conditions. We *are* offering means to overcoming some of the cost handicaps that are making profits difficult to obtain in the process industries today.

THE RAYMOND BROS.

Subsidiary of the International

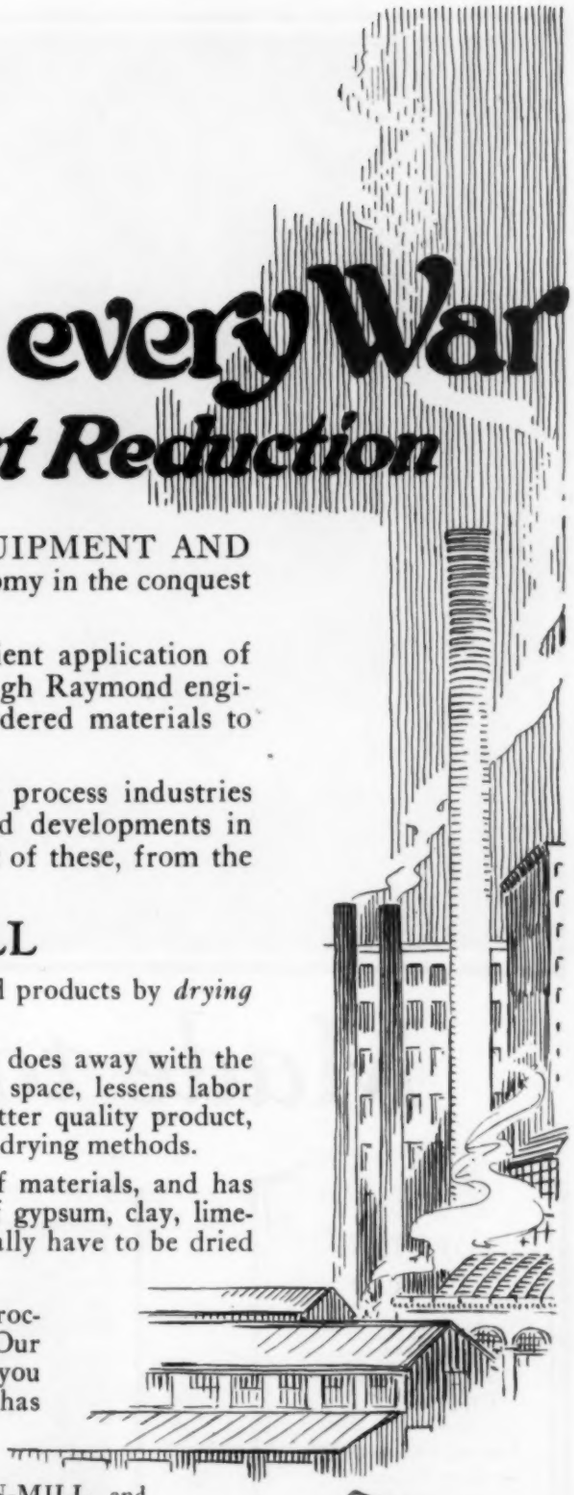
342 Madison Ave., New York

1311 North Branch



that follows every War

the Battle for Cost Reduction



For a period of forty years, RAYMOND EQUIPMENT AND METHODS have been allied on the side of economy in the conquest of rising production costs.

Well-built pulverizing machinery, and the efficient application of that machinery to each individual problem, through Raymond engineering service, have enabled producers of powdered materials to effect substantial savings.

New opportunities for increasing profits in the process industries are made possible by constant improvements and developments in Raymond equipment. One of the most important of these, from the standpoint of cost reduction, is the

Raymond KILN-MILL

which greatly simplifies the manufacture of powdered products by *drying and grinding* in a single, simultaneous operation.

Its advantages are self-evident and far-reaching. It does away with the usual dryer equipment, and thus saves extra building space, lessens labor and upkeep costs, delivers a more uniform and a better quality product, and eliminates possibility of spoilage due to improper drying methods.

The KILN-MILL is applicable to a wide variety of materials, and has been used with notable success in the *dry grinding* of gypsum, clay, limestone, coal, white lead and other substances that usually have to be dried before pulverizing.

Perhaps your product may be more economically processed by the *drying-in-the-mill* method of grinding. Our engineers will be glad to advise you on this point, if you will let us know what specifications your product has to meet.

Our new book gives full particulars of the KILN-MILL, and describes the recent developments in Raymond pulverizing equipment. Ask for

A New Frontier in Methods of Pulverizing and Handling Powdered Materials.

Write for your copy today. It will be mailed promptly on request.

IMPACT PULVERIZER CO.

Combustion Engineering Corporation

Street, Chicago

Subway Terminal Bldg., Los Angeles

DEVINE E

Single

or M

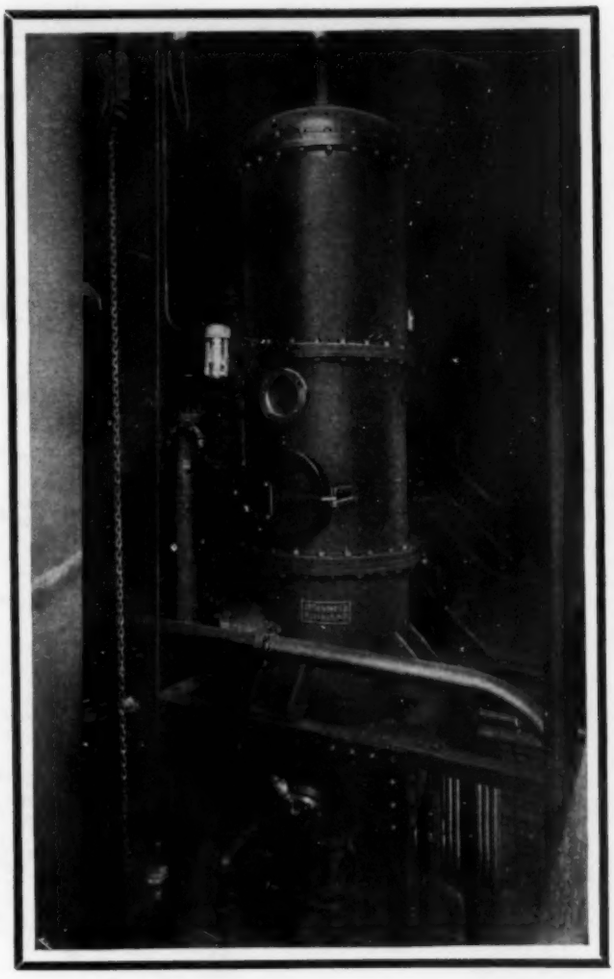
DEVINE

Made to operate under s

DEVINE
Products

- Vacuum Evaporators
- Vacuum Pans
- Vacuum Chamber Dryers
- Vacuum Rotary Dryers
- Vacuum Impregnators
- Vacuum Stills
- Vacuum Condensers
- Vacuum Pumps
- Vacuum Drum Dryers
- Kettles
- Stills
- Columns
- Retorts
- Caustic Pots
- Sulphonators
- Digesters
- Autoclaves
- Nitrators

EVAPORATORS



Multiple Effect

specific conditions—

Broad experience in the field of evaporation, a modern, fully equipped laboratory for experimenting and perfecting apparatus to meet specific conditions, are two reasons why Devine equipment is found in plants of the most progressive manufacturers of this country.

Coupled with this engineering and research ability is a manufacturing plant that is capable of meeting the most exacting requirements for close accuracies on small work and capacity to handle exceptionally large equipment.

However Devine activities are not confined to the field of evaporation alone, but cover a wide range of operations throughout the process industries.

We will be glad to assist you in developing apparatus that will do better work for you. Write for details or ask for one of our representatives to call.

J. P. DEVINE COMPANY

1370 Clinton Street, BUFFALO, N. Y.

51 E. 42nd St., New York City

1314 Peoples Gas Bldg., Chicago, Ill.

738 Real Estate, Title & Trust Bldg., Philadelphia, Pa.

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Jas. Livingston, Ltd. Aldwych House W. C. 2, London, England

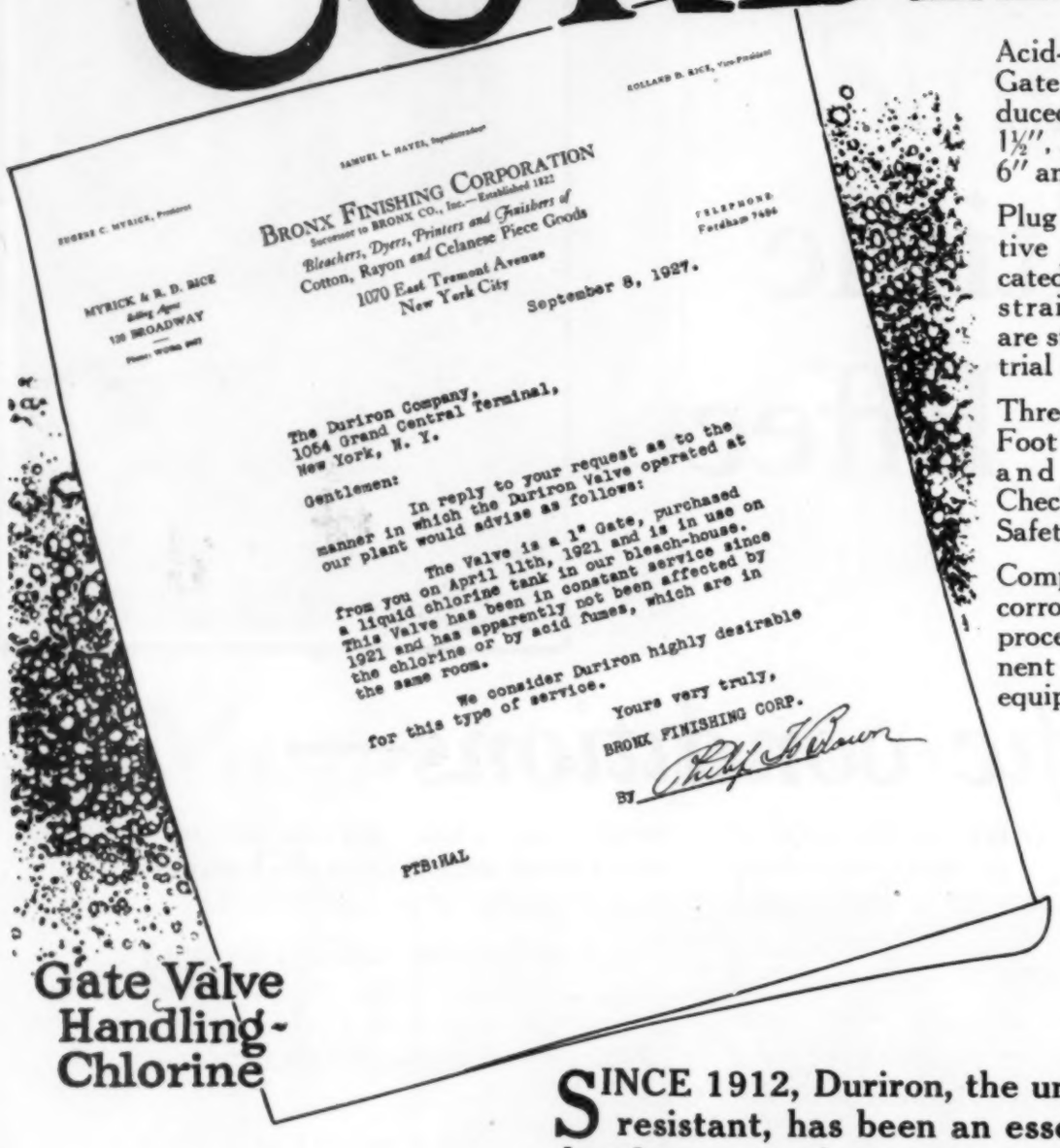
Water Works Supply Co. 210 Sharon Bldg., San Francisco, Cal.

Water Works Supply Co., Wright & Callender Bldg., Los Angeles, Cal.

A. L. Pollard, Knoxville, Tenn.

Water Works & Power Equipment Co. 403 White Bldg., Seattle, Wash.

CURBING C



BRONX FINISHING CORPORATION
Successor to BRONX CO., Inc.—Established 1822
Bleachers, Dyers, Printers and Finishers of
Cotton, Rayon and Celanese Piece Goods
1070 East Tremont Avenue
New York City
TELEPHONE Fordham 7484

September 8, 1927.

The Duriron Company,
1054 Grand Central Terminal,
New York, N. Y.

Gentlemen:

In reply to your request as to the manner in which the Duriron Valve operated at our plant would advise as follows:

The Valve is a 1" Gate, purchased from you on April 11th, 1921 and is in use on a liquid chlorine tank in our bleach-house. This Valve has been in constant service since 1921 and has apparently not been affected by the chlorine or by acid fumes, which are in the same room.

We consider Duriron highly desirable for this type of service.

Yours very truly,
BRONX FINISHING CORP.
By

PTB:HAL

Gate Valve Handling-Chlorine

Acid-proof Duriron Gate Valves are produced in sizes: 1", 1½", 2", 2½", 3", 4", 6" and 8".

Plug Valves of positive release, lubricated, and standard straightway types are stocked in industrial sizes.

Three-way Cocks, Foot Valves, Vertical and Horizontal Check Valves and Safety Valves.

Complete control of corrosive solutions in process by permanent and efficient equipment.

SINCE 1912, Duriron, the universal acid resistant, has been an essential in the development of processes where corrosives destroy other materials.

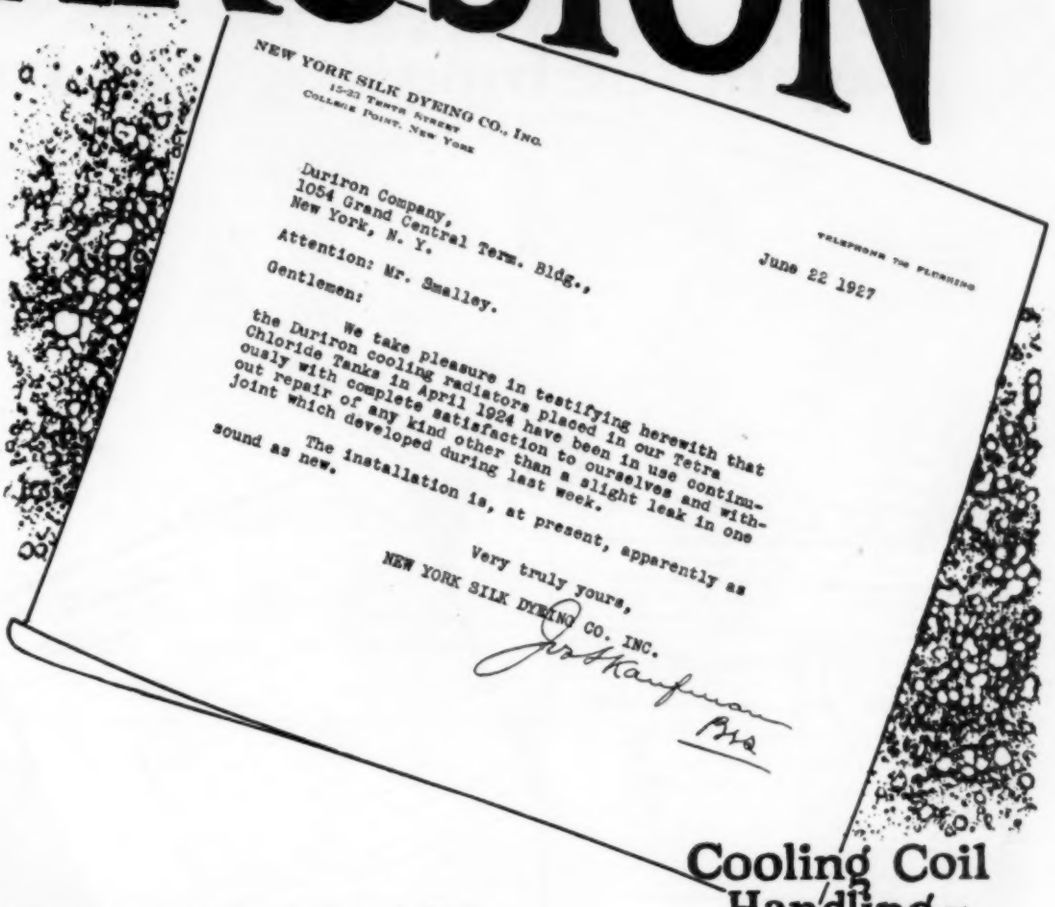
The DURIRON
DAYTON

GCORROSION

Duriron submerged coils, either carrying corrosives inside, or handling steam in an acid bath, solve many process problems.

For circulating, pickling, bright dipping, plating and similar operations, Duriron Circulating Steam Jets offer essential economies and betterments.

Duriron pumps, ejectors, pipe and fittings, exhaust fans, condensers, kettles and special shapes meet all needs of the process industries.



NEW YORK SILK DYEING CO., INC.
15-23 Tenth Street
College Point, New York

TELEPHONE 700 FLUSHING

June 22 1927

Duriron Company,
1054 Grand Central Term. Bldg.,
New York, N. Y.

Attention: Mr. Smalley.

Gentlemen:

We take pleasure in testifying herewith that the Duriron cooling radiators placed in our Tetra Chloride Tanks in April 1924 have been in use continuously with complete satisfaction to ourselves and without repair of any kind other than a slight leak in one joint which developed during last week.

The installation is, at present, apparently as sound as new.

Very truly yours,
NEW YORK SILK DYEING CO. INC.

Jos Kaufman
Pres.

Cooling Coil Handling ~ Tin Tetra Chloride

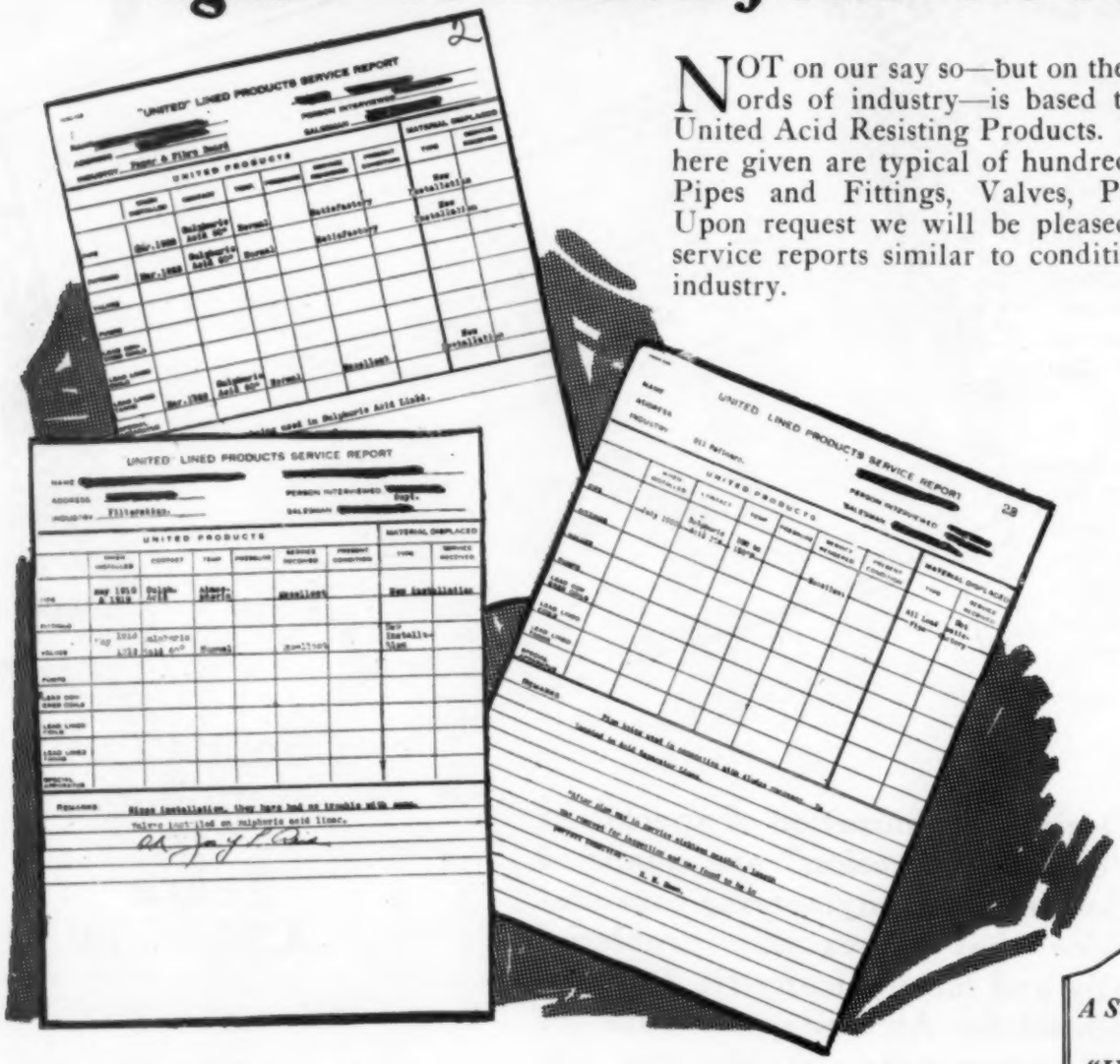
THE Duriron organization of specialists in "curbing corrosion" are qualified to, and do furnish an engineering consultation service that solves new problems. Chemically and mechanically fit, Duriron, supplemented by Alcumite, the superior aluminum bronze, puts virtually any corrosive handling process on a dependable commercial basis.

COMPANY

OHIO

PREVENTING CORROSION in Pipe and fittings

-again the Industry tells its story



NOT on our say so—but on the actual records of industry—is based the story of United Acid Resisting Products. The reports here given are typical of hundreds, covering Pipes and Fittings, Valves, Pumps, Etc. Upon request we will be pleased to submit service reports similar to conditions in your industry.

"United" Lined is the LEAKPROOF kind

"United" Equipment has an enviable record of success in industries such as: Cellulose Products, Dyestuffs, Explosives, Fine Chemicals, Heavy Chemicals, Leather, Coal Products, Lime, Food Products, Paint and Varnish, Paper and Pulp, Petroleum, Rubber, Soap, Fertilizer, Metals and Alloys, Wood Products. *Investigate!*

A Sure Saving

Use "UNITED" PRODUCTS

Chemical Lead Lined Pipe and Fittings

for the handling of Dilute Sulphuric, Sulphurous and other acids, mine and salt water, etc.

Tin-Lined, Brass-Lined and Copper-Lined Pipe and Fittings.

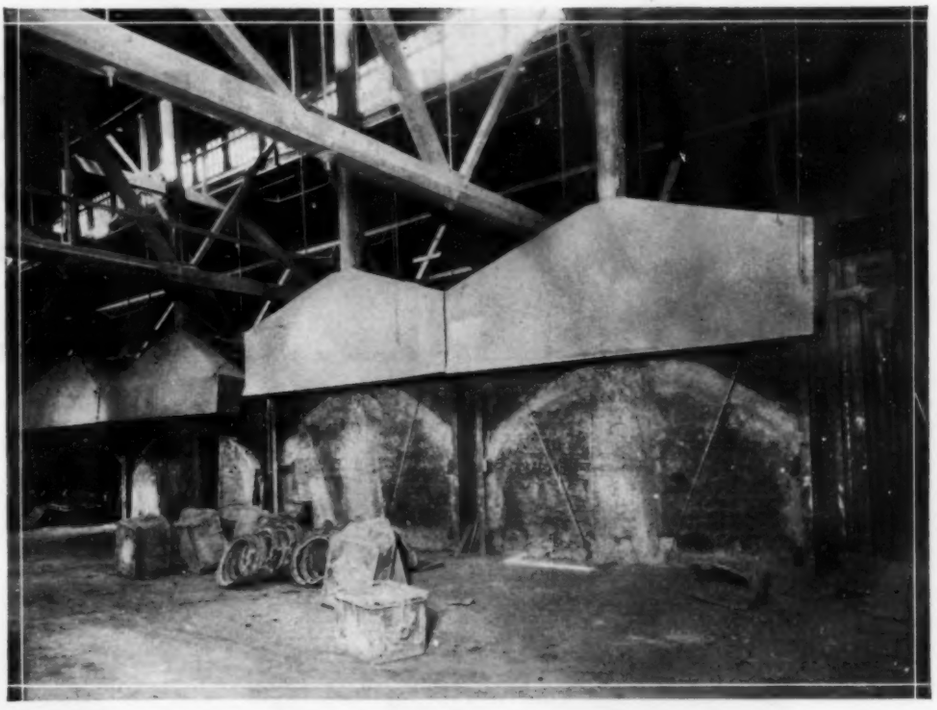
Acid Valves, Chemical Lead and Tin Covered Pipe and Fittings.

Hard Lead Centrifugal Acid Pumps.

UNITED LEAD CO

111 BROADWAY. NEW YORK, U.S.A.

Canadian Distributors: Hoyt Metal Co., Toronto



Malleable Annealing Costs Reduced $1.52 per Ton

ANNEALING costs in the 90 pot double-compartment malleable furnace on the right, insulated with Nonpareil Brick in 1922, average $1.52 per ton of iron annealed less than in the similar uninsulated furnace on the left, operating under the same conditions.

This saving is itemized as follows:

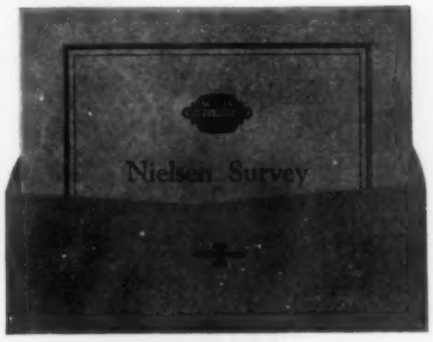
$.261 per ton iron in brickwork costs
.367 per ton iron in fuel costs
.900 per ton iron in annealing box costs
$1.528 per ton, total

A complete cost analysis was made on these two furnaces by the A. C. Nielsen Company in cooperation with the Eberhard Manufacturing Company, Cleveland, who operate them. A copy of this report, which has been approved by Mr. Walter G. Quayle, foundry superintendent, will be sent you promptly. Just return the coupon below.

ARMSTRONG CORK & INSULATION COMPANY
Division of Armstrong Cork Company
156 Twenty-fourth Street, Pittsburgh, Pa.

Complete Data Ready for You

If you are interested in knowing what it costs Eberhard to anneal castings, just return the coupon below. A copy of the complete report will be sent you promptly, without obligation.



Nonpareil Insulating Brick

For Furnaces and Ovens

ARMSTRONG CORK & INSULATION CO.
156 TWENTY-FOURTH ST.
PITTSBURGH, PA.

Gentlemen: Without obligating me in any way, you may send me a copy of the Engineering Report and the book, "Nonpareil Insulating Brick."

Name .....
Address .....
City ..... State.....
....

Resistance WIRE and

Chromel
MEANS ELECTRIC HEAT

Hoskins

THE WIRE THAT MADE

RIBBON DATA

This catalog gives complete technical data on Hoskins Chromel resistance wire and thermocouples.

It is compiled from the viewpoint of the user and will be particularly helpful to those interested in Chromel from the standpoint of *electric heating*. It gives complete figures on resistance, and current-carrying capacities of Chromel A and C. Particular reference is made to cold-rolled Chromel A electric furnace ribbon, and also to hot-rolled flats, rounds and squares.

Resistance figures are also given on Copel (Nickel-Copper) and Pure Nickel.

If you are concerned with resistance wire for any purpose, you should have this Catalog. It is not a piece of sales literature, but is essentially a hand-book of convenient pocket size, for the engineer.

And the alloy that it describes, Chromel, is the alloy that virtually brought the electric heating industry into existence, when it was discovered in 1906. Some place in your plant, you can probably use electric heat to advantage. But in any event, the data that is in this booklet would be helpful to anyone interested in resistance wire.

Ask for Catalog E. C.

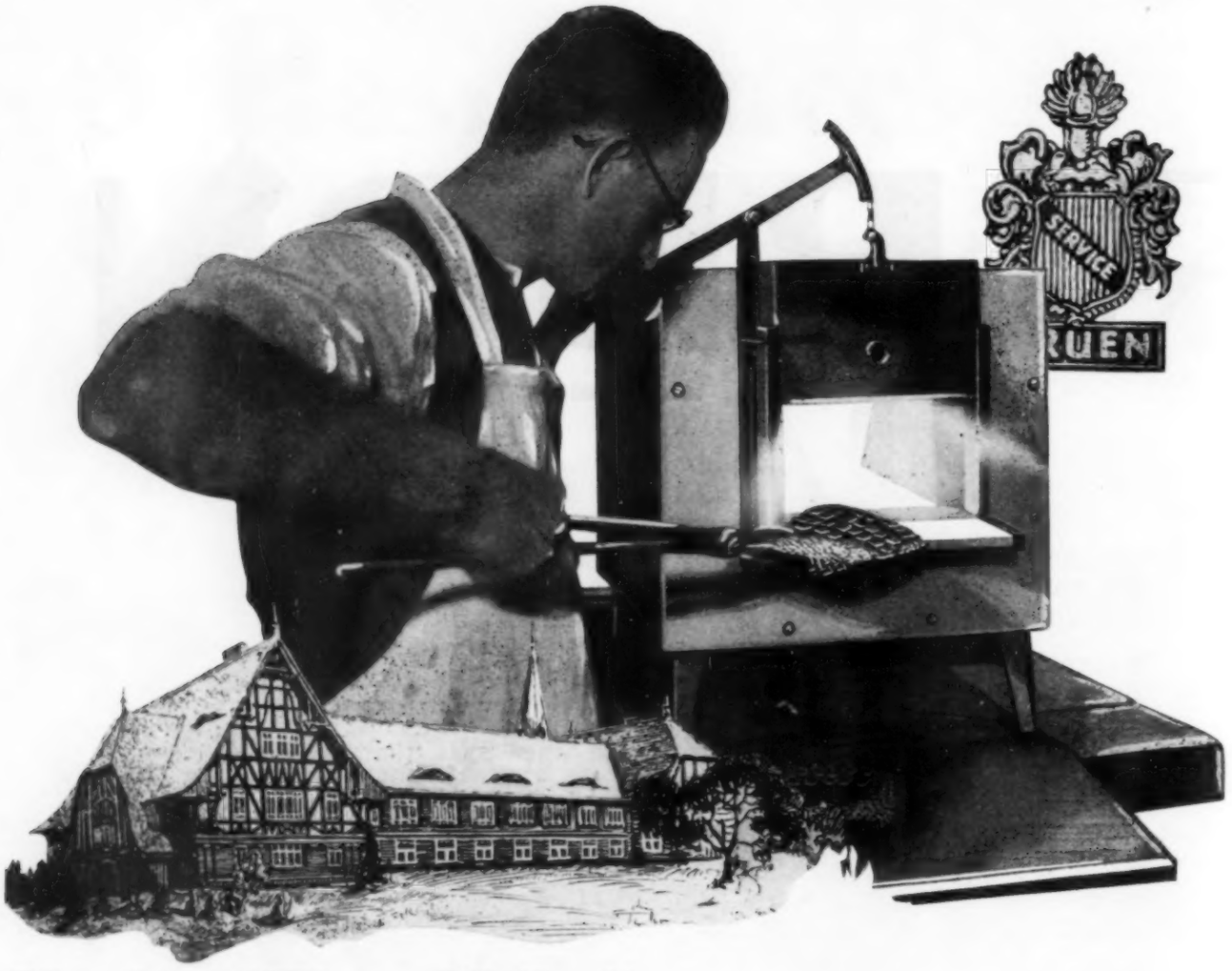
Hoskins Manufacturing Company, Detroit
4433 Lawton Avenue

New York Grand Central Terminal
Boston Park Square Building
Cleveland Leader-News Building
Chicago Otis Building
San Francisco 1151 Market Street

Canadian Rep.: Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ontario

Chromel

ELECTRIC HEAT POSSIBLE



Up On "Time Hill—"

"Time Hill," Cincinnati, is graced by the beautiful property of the Gruen National Watch Case Company, makers of fine time-pieces.

And somewhere in that place of craftsmanship, you'll find this small Hoskins Laboratory Furnace, doing some kind of very useful work, making its contribution to the fine quality of the Gruen products.

It is interesting by contrast that you'll find these same Hoskins Furnaces in the roaring, rumbling steel mills throughout the country. And the same reliability that makes them liked by Gruen has won the acceptance of the steel mill laboratory.

And for your laboratory they offer the same service. Their CHROMEL units stubbornly hold up under hundreds of hours of heat. And they are easy to re-new. Just slide them into the slotted muffle slabs, through the door opening.

For more information write to your dealer.

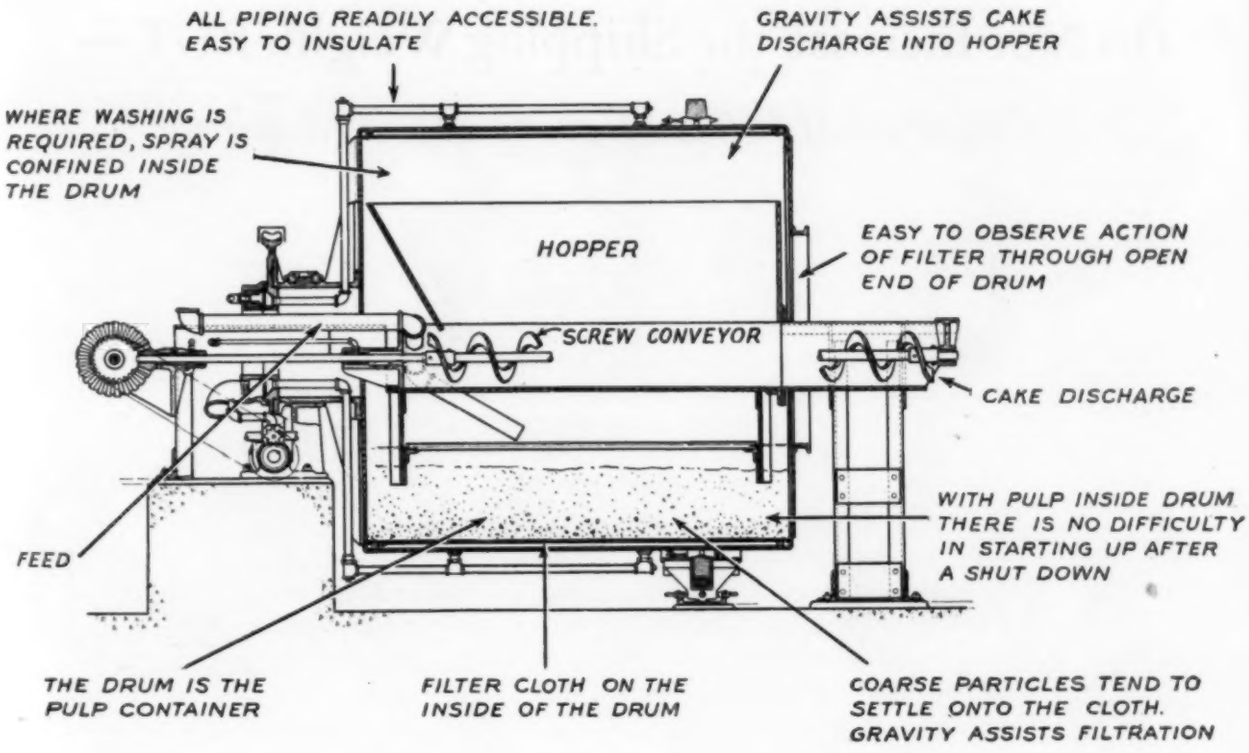
HOSKINS MFG. CO., 4437 Lawton Ave., Detroit

CHICAGO Otis Bldg. CLEVELAND Leader Bldg. BOSTON Park Square Bldg.
NEW YORK Grand Central Terminal SAN FRANCISCO 1151 Market Street

Hoskins Electric Furnaces

Originators and Manufacturers of Chromel The Alloy that made Electric Heat Possible

ONE GLANCE THROUGH A DORRCO FILTER shows why this machine is attracting such widespread attention.



SOME of the salient points of the Dorrco Filter are illustrated above.

A thorough examination of an actual machine will further convince you of the distinctly attractive features of this continuous vacuum Filter.

Send for Bulletin No. 8071

DORRCO

THE DORR COMPANY

ENGINEERS

247 PARK AVENUE NEW YORK CITY

DENVER
1009 17th St
LOS ANGELES
108 W. 6th St
WILKES-BARRE
536 Miners Bank Bldg
THE DORR CO. LTD.
16 South Street, London E C 2

TORONTO 330 Bay St
DORR G.m.b.H.
Joachimsthalerstr 10 Berlin W 15

CHICAGO
310 S. Michigan Ave
ATLANTA
1503 Candler Bldg
JOPLIN
319 Joplin National Bank Bldg
SOC. DORR et CIE.
126 Rue de Provence Paris 8

INVESTIGATION TESTS DESIGN EQUIPMENT

Experience and Service
Do Not Increase the Shipping Weight, BUT—
they are vital parts of every Dorr Machine

BUILT into every Dorr Machine is an important, though intangible, part—a part that represents the experience gained through years of study of different plant conditions and through exhaustive development work in the laboratory and in the field. In the field particularly, for no new developments or changes in Dorr Equipment are adopted as standard, until they have first passed through an extended test period of actual plant operation.

A special Service Department, made up of thoroughly experienced engineers, is maintained. The work of this Department consists solely of inspecting new Dorr installations, supervising the "starting up" of such installations, assisting and instructing your operators in how to obtain the most profitable results.

Nor does this Service end after the equipment is first put in operation. We are as much interested in the successful operation of machines that have been in service for several years, as we are in that of machines that are due to start operating tomorrow.

DORRCO

Dorr Agitators	Dorrco Filters	Dorr Slurry Mixers	Dorrco Sand Washers
Dorr Classifiers	Dorr Washers	Dorr Save-Alls	Dorrco Bar Screens
Dorr Thickeners	Dorrco Pumps	Fahrenwald Sizers	Dorrco Screens

Dorr Sewage Clarifiers Dorr Water Clarifiers Dorr Digesters

THE DORR COMPANY
ENGINEERS

247 PARK AVENUE NEW YORK CITY

DENVER
1009 17th St
LOS ANGELES
108 W 6th St
WILKES-BARRE
536 Miners Bank Bldg

CHICAGO
310 S Michigan Ave
ATLANTA
1503 Candler Bldg
JOPLIN
319 Joplin National Bank Bldg

TORONTO 330 Bay St

THE DORR CO. LTD.
16 South Street, London E C 2

DORR G.m.b.H.
Joachimsthalerstr 10 Berlin W 15

SOC. DORR et CIE.
126 Rue de Provence Paris 8

INVESTIGATION TESTS DESIGN EQUIPMENT

INSULIN—the life-saver of thousands—

MADE IN GLASS-LINED EQUIPMENT

Where the standard of purity demands exactness
Pfaudler equipment fills the requirement!

View showing battery of Pfaudler Equipment in the Eli Lilly Co., Indianapolis, Ind.

ONE of the greatest contributions to medical science in the last fifty years was the discovery of insulin for the treatment of sugar diabetes. How to produce this on a commercial scale and yet comply with laboratory accuracy proved to be a problem. After due consideration the Eli Lilly Co. and E. R. Squibb & Sons installed Pfaudler Glass-Lined Equipment.

As a result thousands of people's lives have since been prolonged, and the remedy obtained at a nominal expense.

Whether you manufacture C. P. Chemicals, Pharmaceuticals, Cosmetics or Concentrated Food Products, you can always be assured that acid resisting glass-lined equipment will enable you to meet laboratory conditions on a commercial scale.

Glass-lined vacuum stills, condensors, evaporating dishes, sulphonators, mixing and storage equipment.

The Pfaudler Company
Rochester, New York

Send me your new "Interchangeable Series" Catalog describing your new process equipment.

Name .....

Company .....

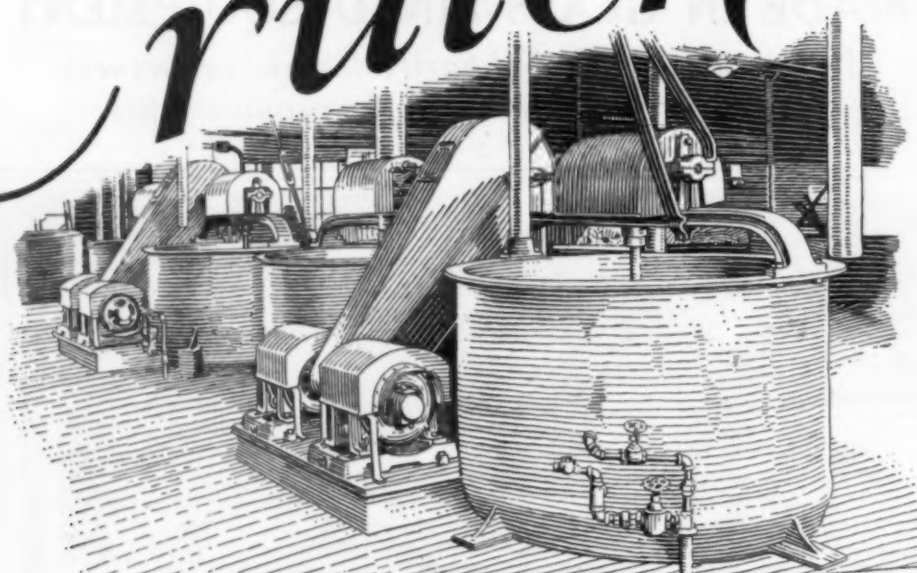
Address .....

C.M.E. 12-27

THE PFAUDLER COMPANY - *Chemical Division* - ROCHESTER, N. Y

PFAUDLER

Crutching



POTTER DRUG & CHEMICAL CORPORATION
(MAIN OFFICE & LABORATORIES)
123-153 MEDFORD STREET
MALDEN, MASS. U.S.A.

PRINCIPAL DEPOTS
LONDON 27 CHARTERHOUSE SQ.
PARIS, 5 RUE M LA PAIX.
AUSTRALIA, R TOWNS & CO. SYDNEY

FREIGHT ADDRESS
BELLROCK STATION, MASS.
CABLE ADDRESS
POTTERCO, BOSTON

C.

November 2nd, 1926.

General Electric Company
1 River Road
Schenectady, N.Y.

Gentlemen:-

The motors shown in the picture as driving the crutchers are General Electric Motors. We might add that we are using G-E motors throughout the entire plant and they are giving us perfect satisfaction.

We have found it to be to our advantage to standardize on one make of motor on account of interchangeability and the fact that we do not have to keep a large variety of repair parts on hand.

Very truly yours,

POTTER DRUG & CHEMICAL CORPORATION.

E. A. Ray.
Supt.

Apply the proper G-E motor and the correct G-E controller to a specific task, following the recommendations of G-E specialists in electric drive, and you have G-E Motorized Power. Built in or otherwise connected to all types of industrial machines, G-E Motorized Power provides lasting assurance that you have purchased the best.

GE **Motorized Power**
—fitted to every need

GENERAL

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

in the Process Industries
As in the manufacture of soap

Strip this process of its quaint name—a name derived from the crutch-shaped paddle formerly used—and we have the fundamental process of mixing.

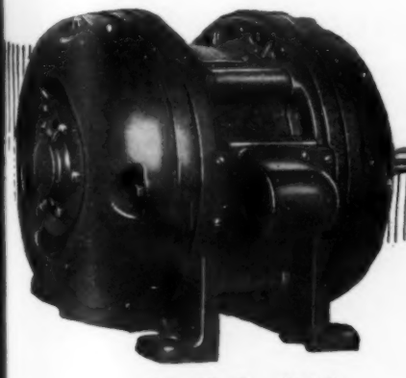
The requirements of mixing and hence of crutching-drives are admirably met in the many listed lines of standard G-E induction motors. General Electric's standard motors have been refined to such a degree that they are applicable to a great range of service and possess insulation which provides exceptional protection for all but the most adverse conditions. In addition, these standard motors are comparatively inexpensive, are easily applied, and require only simple control apparatus.

If crutcher motors must be located where hot alkalies can splash or boil over on them, General Electric's new lines of totally enclosed, fan-cooled motors are recommended. These motors are smaller and lighter than any totally enclosed motors heretofore developed and are interchangeable with open motors. Special control designed to meet these conditions is also available.

G-E process plant specialists are available at your nearest G-E office to provide you with complete information as to the application of motors and controllers to all types of process plant drives.

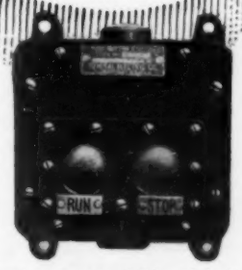
GENERAL ELECTRIC supplies complete electrical equipment, together with valuable operating data and service, for every mixing application in the process industries, including:

- Cement & Lime
- Ceramics, Clay, Glass
- Electrochemical Products
- Explosives & Cellulose
- Fertilizers
- Fine Chemicals
- Heavy Chemicals
- Wood Chemicals
- Food Products
- Glue & Gelatine
- Leather
- Oil—Vegetable & Animal
- Paints & Varnish
- Petroleum Refining
- Pulp & Paper
- Rubber
- Soap
- Sugar



One of the line of totally enclosed, fan-cooled motors for application in adverse environments

Type CR7006-D8 magnetic switch (cover removed) for use with these motors. It is enclosed in a cast-iron dust-tight case

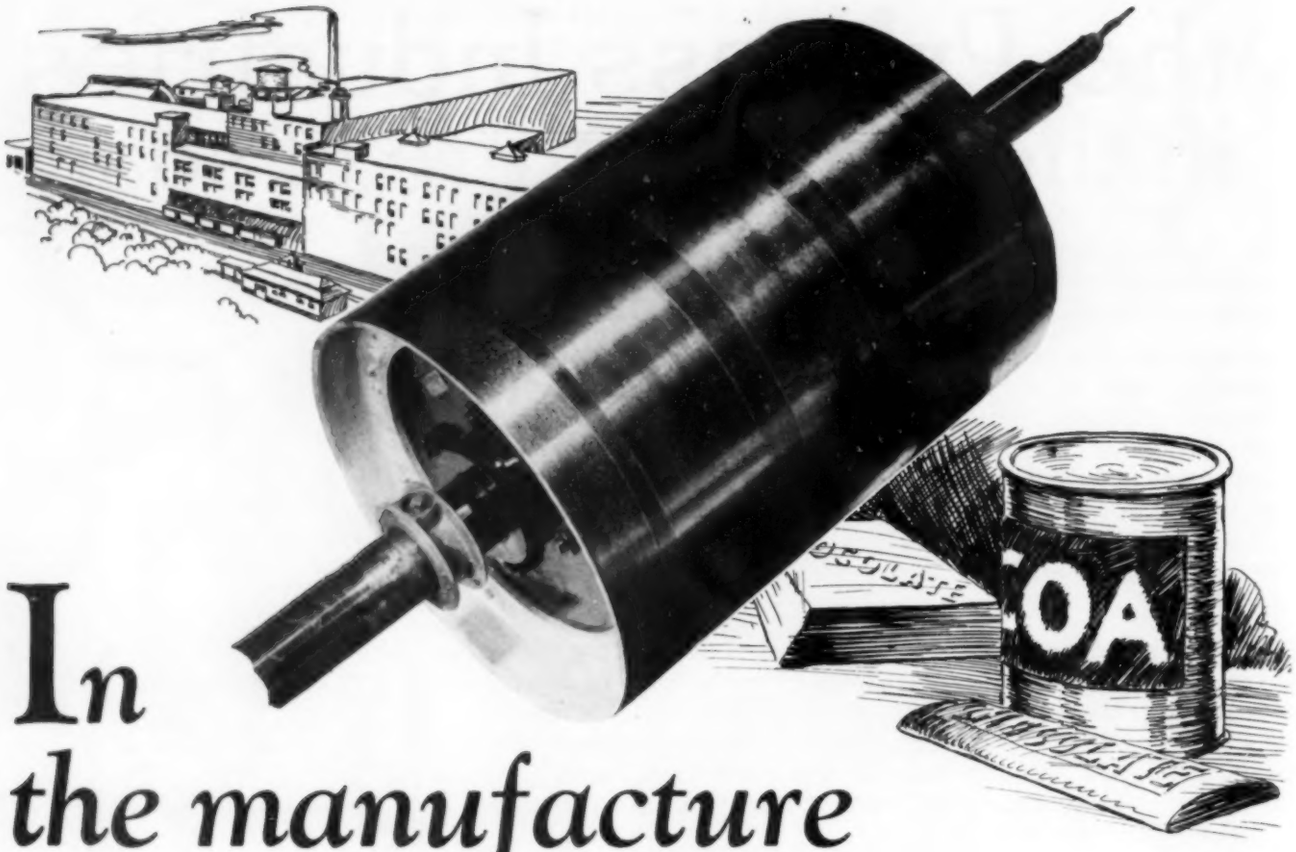


Dust- and water-tight push button station, Type BS-4-PP. Admirably suited for adverse conditions

200-92

ELECTRIC

SALES OFFICES IN PRINCIPAL CITIES



In the manufacture of chocolate.....

THE Dings Magnetic Separator is extensively used in the manufacture of food stuffs such as puffed rice, beans and chocolate. It protects the good name of the product by removing every bit of iron and steel.

Among the makers of chocolate using the Dings Separator is the Ideal Cocoa and Chocolate Co. of Lititz, Pa. In a recent letter they state, "the separator has to date given excellent service and has protected the machine to which it is attached in a very thorough manner."

Have you investigated what magnetic separation will do for your product? Dings has specialized on magnetic separation for over 25 years. Put your problem up to us. We can solve it.

DINGS MAGNETIC SEPARATOR CO.
666 Smith Street, Milwaukee, Wisconsin

Boston
304 Rice Bldg.

San Francisco
419 Call Bldg.

Dings High Intensity MAGNETIC SEPARATION

New York City
30 Church Street

Seattle
2208 First Ave., South

C&ME 11-Gray

depend on this!

THERE are two major considerations in the purchase of chemical lime. First, adaptability to process. Second, the assurance of the same efficiency and economy throughout every shipment. ¶ For over half a century Speed Chemical Lime has been proving both qualities to a constantly growing number of exacting customers. It is entirely possible that Speed can establish new and higher standards in *your* process. Once this is determined, you can count on the same results permanently.

LOUISVILLE CEMENT CO., *Incorporated,* Louisville, Ky.

SPEED LIME

Send for samples and analysis of Speed Chemical Lime today. It will not obligate you. It may help you. Extensive quarries, large plant capacity and efficient traffic management insure prompt deliveries. Speed Chemical Lime (lump form). Average calcium oxide content, 95%. Speed Chemical Hydrated Lime.

Says the Chief Engineer

"When I got my license back in '99, nobody thought much of combining bookkeeping with steam engineering. In those days the superintendent didn't come bothering a man about 'percentage of efficiency in production of steam'. Now, by George, they want to know exactly,—and you can't depend on instinct or on a fireman's guesses for that. No sir, rule of thumb is out of date. Today, with competition so keen, the motto is 'make every penny count.'

"I'm not kicking, though. They put in Republic Flow Meters and I can split decimal points with them now. Run my power plant like other departments?' says I. 'All right, gentlemen. The boiler room has nothing to lose from records.' Fact is, we gain. I was going to demand a new boiler, but by watching the meters I can distribute the load so we don't need it,—not this year. When we do, my records will get it for me.

"I got gray-headed guessing about steam, then worrying about my guesses. But I don't even 'estimate' any more, using Republic Flow Meters. I know."

P. S. The Accountant will talk to you next month.

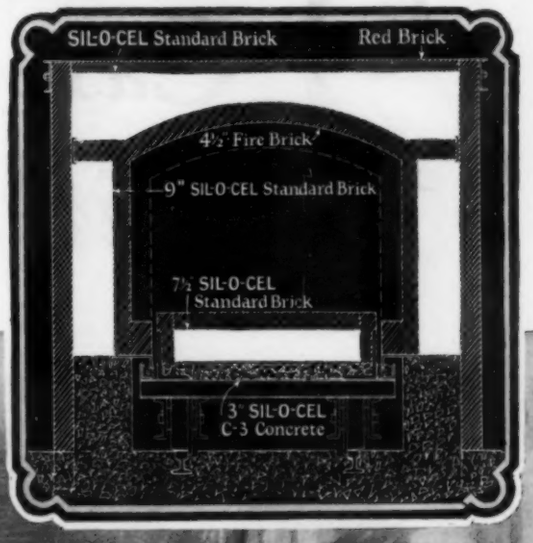
"Bulletin Steam Economy Mailed on Request"

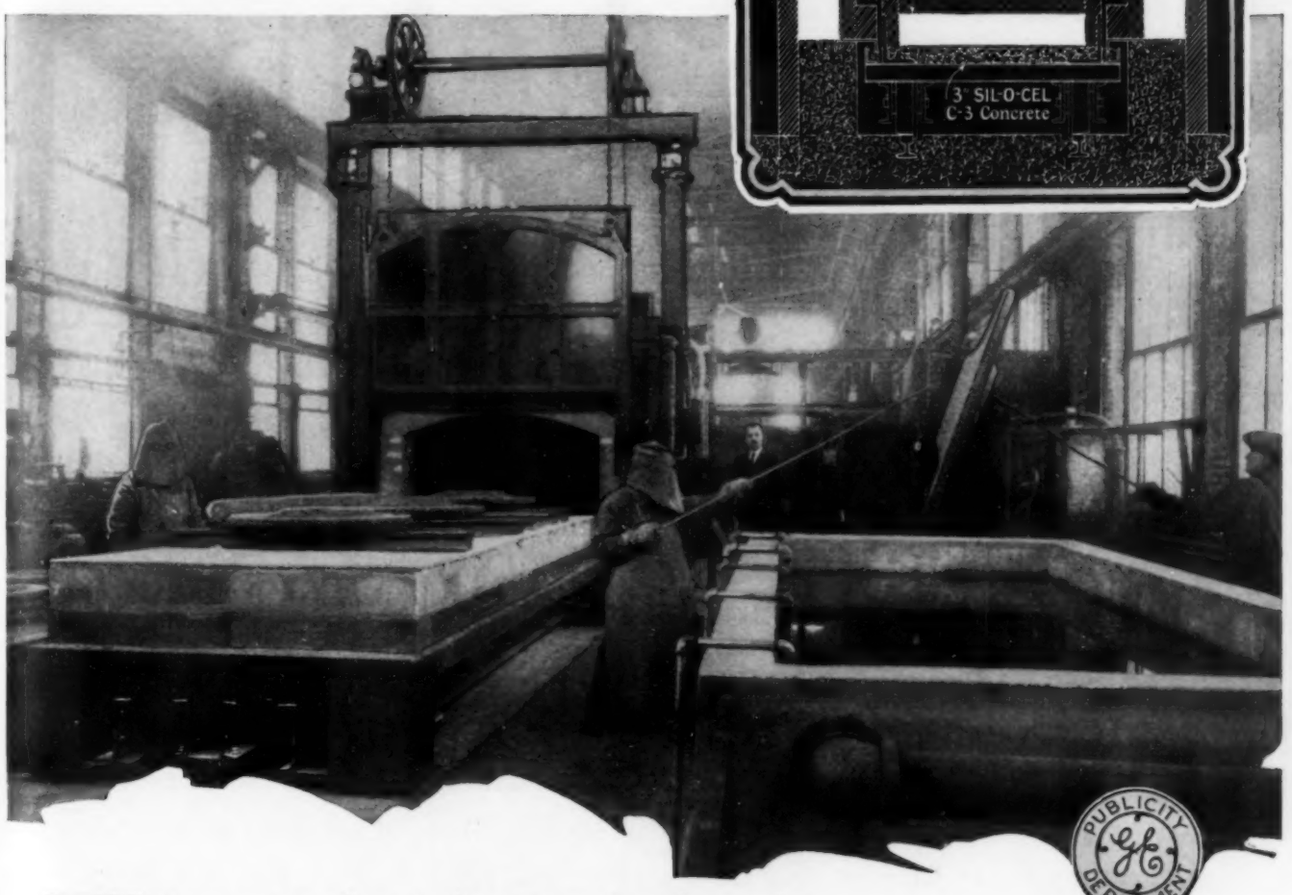
Republic Flow Meters Co.

Factory and General Offices, 2233 Diversey Parkway

CHICAGO, U. S. A.

General Electric Furnaces *are insulated with* Sil-O-Cel





THIS car-type electric heat treating furnace, a General Electric product, is used for annealing and heat treating steel castings.

SIL-O-CEL

Note in the drawing at the top how Sil-O-Cel insulation completely surrounds the charge, even in the base of the car. Electric furnaces invariably are *insulated*.

Sil-O-Cel insulation is available in the form of brick, block, powder and cement, and course aggregate for making insulating concrete.

Write for our Engineering Service Bulletin G-8 on the insulation of oil, gas and coal, as well as electrically-heated furnaces.

BARRIERS
FILTER-CEL
SUPER-CEL
SIL-O-CEL
CELITE

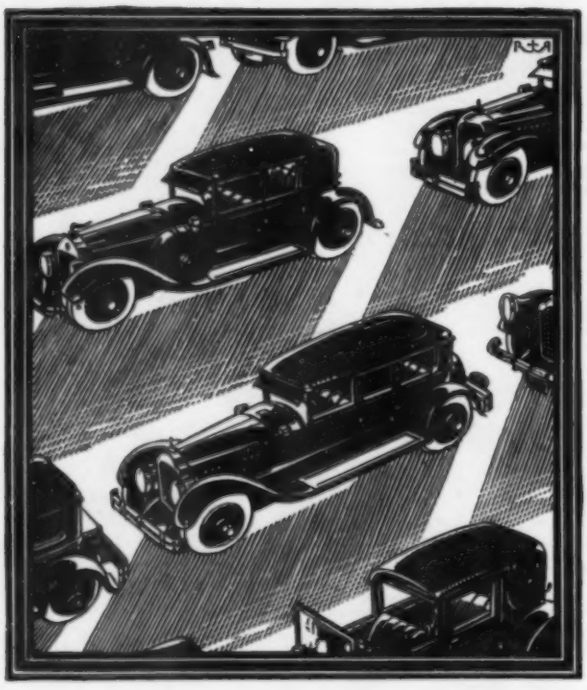
CELITE PRODUCTS COMPANY

11 Broadway NEW YORK — 225 E. Superior St. CHICAGO — 1320 S. Hope St. LOS ANGELES

Offices and Warehouses in Principal Cities

Celite Products Limited, New Birks Bldg. Montreal, Quebec
Celite Products Corporation, Windsor House, Westminster, London

9 Cars *in* 4 Cities *in* 1 Day



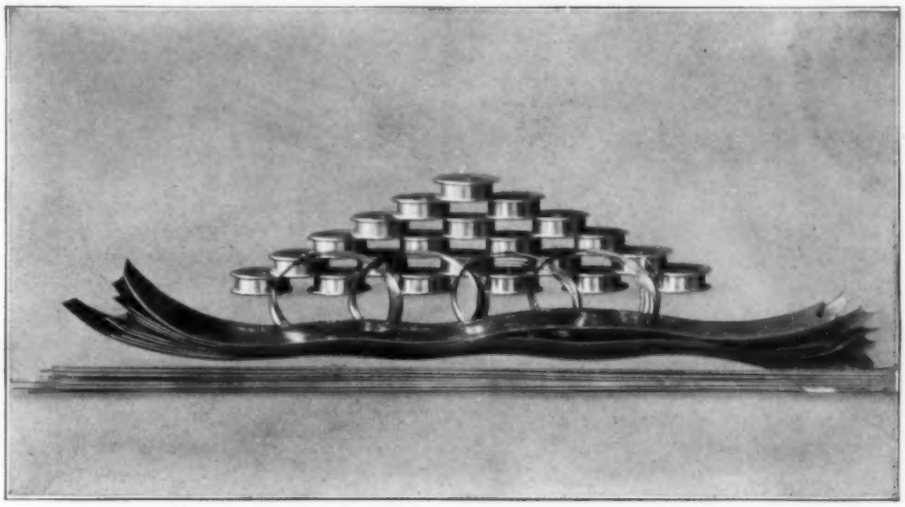
A NEW BRITAIN, Connecticut, car dealer is said to sell more automobiles per capita, of a certain high-priced make, than any other subdealer in the world. In clearing his floor of trade-ins, he uses Long Distance almost exclusively. Not long ago he made ten calls in one day to dealers in other cities. These calls sold two cars in Boston. Two in Worcester. Three in New York. Two in Philadelphia. Cash transactions, $17,000—telephone charges, $19.50!

"I CONSIDER THE TELEPHONE," says this automobile man, "the most valuable and most economical sales asset I have."

Almost any business house has many kinds of work that the long distance lines can do. Buying or selling in a distant city without leaving one's office. Making important appointments. Getting or giving rush information, specifications or prices. All business details can be discussed by telephone, just as in a personal interview. And with heavy savings in time and traveling expense.

What distant person or firm would it be an advantage to talk with, now? You'll be surprised how little it will cost. . . . . *Number, please?*

BELL LONG DISTANCE SERVICE



TANTALUM
is now being fabricated into many finished products

This new elementary metal that resists corrosion to a greater degree than any known metal or alloy can be colored with iridescent reds, blues, purples and greens.

In commercial form Tantalum has been available for less than a year. Yet already manufacturers in the most varied fields are fabricating this new elementary metal into their finished products. Others are making plans for its use. Still others are carrying on research with a view to its adoption. The demand for Tantalum has grown so rapidly that our plant is running at full production and we are planning an increase in capacity.

This instant recognition of the possibilities of Tantalum is due to its unique properties. Resisting corrosion by practically all chemical reagents except hydrofluoric acid and hot caustic, Tantalum is one of the most noble of metals. In this respect it surpasses even gold for it is not attacked by aqua regia, hot or cold. Yet with all these characteristics it is available in commercial quantities for one-third the price of gold.

Besides possessing unique stability and natural beauty, Tantalum can be colored with exquisite permanent reds, blues, purples and greens that are highly iridescent. This gives Tantalum unusual possibilities as a semi-precious art metal.

This new metal can be worked cold with comparative ease. It can be drawn, hammered, machined, punched, hardened, rolled, polished, etc. While it cannot be soldered or worked hot in the atmosphere, it can be spot-welded to itself or other metals. It is now available in wire, bar, sheet, lap-welded tubing, and special shapes to meet individual requirements.

Tantalum is rapidly becoming well known to the public. Judging from all present indications, it is destined to become one of the most highly prized of all metals. If you think you can profit by the fabrication of Tantalum into your finished products, or if you wish to experiment with this metal, we shall be glad to send a small sample sheet for testing. If you wish, our laboratory will be glad to work with you.

FANSTEEL PRODUCTS COMPANY, Inc.
NORTH CHICAGO, ILLINOIS

Characteristics of commercial tantalum

Technical characteristics

Atomic number	73
Atomic weight	181.5
Density	16.6
Atomic volume	10.9
Tensile strength, lb. sq. in.	130,000
Compressibility per kg. per sq. cm.	0.50×10^{-6}
Brinell hardness	45.9
Scleroscope hardness	10
Young's modulus of elasticity kg. per sq. mm.	19,000
Melting point, degrees C	2,770
Specific heat cal. per gm. per degree	0.0365
Linear coefficient of expansion per degree C	7.9×10^{-6}
Thermal cond., in cal. per c. c.	0.130
Heat of combustion, cal. per gm.	1,147
Heat of combustion, cal. per gm. molecule to oxide	301,500
Temp. coefficient of resistance	0.00335
Elec. resistance microhm per c. c. at 25° annealed	14.6
Magnetic susceptibility, X 10^6	0.8
Electrochem. equiv., mg. per coulomb	0.3762
Refractive index	2.05
Thermoelectric e. m. f. against copper, microvolts per degree	4.1

Chemical properties

The most characteristic chemical property of Tantalum is its unusual resistance to chemical corrosion. It is not attacked by hydrochloric or nitric acids or by *aqua regia*, either hot or cold. It is not attacked by dilute sulfuric acid at ordinary or more elevated temperatures, but appears to be slowly attacked by boiling, concentrated sulfuric acid. Solutions of caustic alkalies do not attack the metal easily. Hydrofluoric acid seems to be the only chemical agent which will attack it, and in the case of very pure metal and very pure hydrofluoric acid the action is very slow. A mixture of hydrofluoric and nitric acids will attack the metal with avidity, causing it to go into solution as Tantalum fluoride.

If Tantalum is heated in the air, the surface becomes blue at a temperature of about 400° C., and at a somewhat higher temperature, nearly black. Above a dull red heat the white oxide is produced and the metal gradually burns. This metal combines with avidity with hydrogen, oxygen, or nitrogen. It will take up 740 times its own volume of hydrogen, producing a very coarse-grained, brittle product.

Tantalum containing dissolved gases will be harder than the pure metal, and if their quantity is appreciable the metal may even be brittle—so all annealing or heating operations with Tantalum must be carried out in a vacuum. Solutions of chlorine or the gas itself are without any action on the metal. Tantalum is not affected by any of the chemicals or antiseptics used in dentistry or surgery.

Corrosion data

Below is corrosion data on Tantalum as far as has been actually determined as a guide in determining its suitability for particular uses. Tantalum, in so far as its properties can be compared with other materials, is more resistant to corrosion than any known metal or alloy. In the table, the words opposite the corrosive agent have the following meanings:

EXCELLENT: Resistance to corrosion of such a degree in laboratory and service tests that a long life of years is obtained.

GOOD: Resistance to corrosion of such a degree in laboratory and service tests that commercially long life is obtained.

FAIR: Resistance to corrosion of such a degree in laboratory and service tests that the material may be used when cost is not a consideration.

POOR: Resistance to corrosion of such a degree in laboratory and service tests that the material is useless.

This table takes the form of the table on corrosion worked out by the committee of the Society for Testing Materials under the chairmanship of Jerome Strauss. The ratings given are conservative and it is recommended that the Tantalum be sampled by the user for special processes.

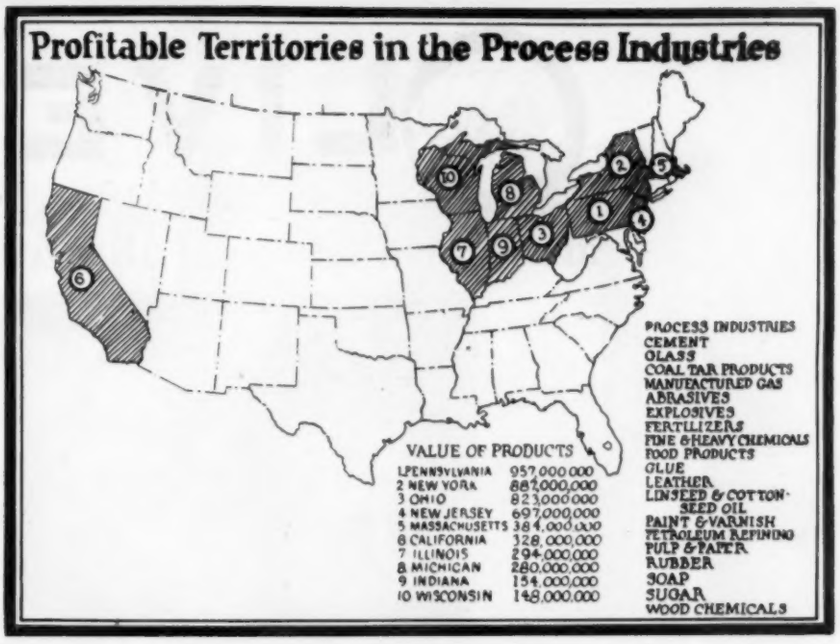
Form of Material Wrought—Sheet, Wire or Bar.

Sulfuric Acid	Dilute	Excellent
	Concentrated and below boiling point	Excellent
Nitric Acid	Very Dilute	Excellent
	Concentrated	Excellent
Hydrochloric Acid	Dilute	Excellent
	Concentrated	Excellent
Aqua Regia		Excellent
Hydrofluoric Acid		Poor
Hydrofluoric and Concentrated Nitric Mixed		Poor
Acetic Acid	10% Solution	Excellent
	Concentrated (Glacial)	Excellent
Formic Acid	12% Solution	Excellent
	50% Solution	Excellent
Oxalic Acid	10% Solution	Excellent
Phosphoric Acid	10% Solution	Excellent
	85% Solution	Excellent
Carbolic Acid	5% Solution	Excellent
Citric Acid Solution		Excellent
Tannic Acid	15% Solution	Excellent
Sodium Acetate	20% Solution	Excellent
Iodine Solution	10% Solution	Excellent
Chlorine Solution		Excellent
Sodium Hydroxide	Dilute Solution	Good
	Hot Concentrated	Poor
Potassium Hydroxide	10% Solution	Excellent
Ammonium Hydroxide		Excellent
Sea Water		Excellent
Sea Air		Excellent
Moist Atmosphere		Excellent
Moist Sulphurous Atmosphere		Excellent
Mine Waters		Excellent
Gases Containing Carbon Monoxide		Excellent

FURTHER INFORMATION IS AVAILABLE ON REQUEST

FANSTEEL PRODUCTS COMPANY, Inc.
NORTH CHICAGO, ILLINOIS

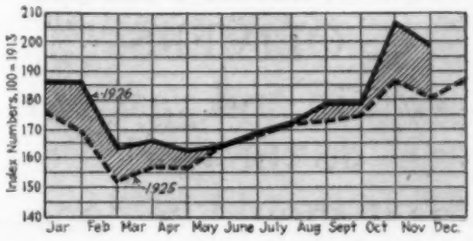
—Printed in U.S.A.



What *goes on...?*

The Men in the Process Industries are thinking about next year! New materials, new processes, new equipment are up for consideration. They want a bird's-eye review of the past year's performance with the high spots that point the way to next year's sales and production plans.

Believing with Mr. Hoover that "statistics are not mental exercises but are the first step toward right decisions" *Chem. & Met.*, in January, brings its Annual Review number for the Process Industries.



This provides the national aspects of these industries . . . This year's issue will be particularly concerned with the Interdependence of the Process Industries . . . *interdependence due to men, methods and materials.*

We are also concerned with new processes and new materials also the matter of prices and the possibilities of future fluctuations.

The field uses this information in making sales and marketing plans for 1928. Their interest in this data is as keen as any sales or advertising man's in analyzing potential fields and the necessary publications for coverage.

A publication thus serving the field must have *reader interest.* And we think we can prove this when we are able to show 71.2% subscription renewal . . . by mail! Don't forget the Annual Review number will be pointing the way to improvements—If your story fits in . . . be sure to broadcast it . . .

Thru *the pages of*

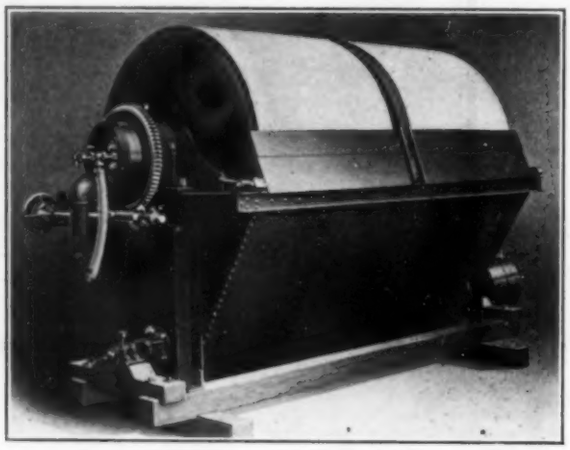
CHEMICAL & METALLURGICAL ENGINEERING

A McGraw-Hill Publication

Tenth Avenue at 36th Street, New York City

OLIVERS

are known and used all over the world



Within the last two months

POLAND ordered *twelve* for Dewatering Concentrates.
WEST AFRICA ordered *seven* for Dewatering and Washing Gold Ore Slimes.
CANADA ordered *three* for Dewatering Concentrates.
INDIA ordered *two* for Dewatering Concentrates.
SPAIN ordered *one* for Dewatering Concentrates.

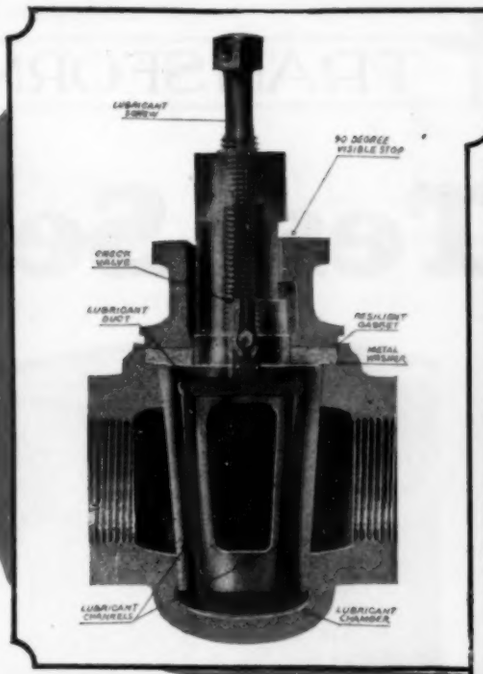
Many others ordered for local use.

All ordered because
OLIVERS
year in and year out
do the work
as it should be done

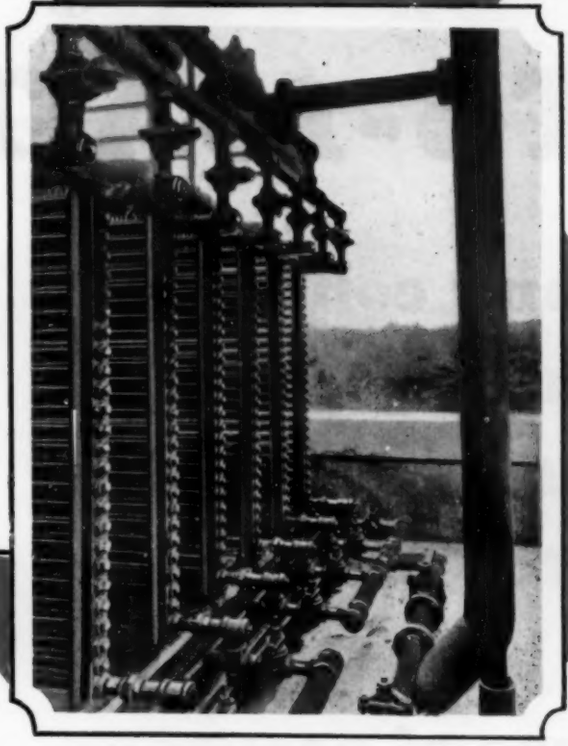
OLIVER Continuous Filter

San Francisco, 503 Market St. · Oakland, Calif., 4th and Madison Sts. · New York, 33 West 42nd St. · London, 11 Southampton Row

Johannesburg, South Africa, E. L. Bateman, Locarno House
Honolulu, T. H., W. A. Ramsay, Ltd.



The plug is lubricated and hydraulically lifted with grease at the same time.



Always Tight

That is why engineers choose

NORDSTROM VALVES

Their seating surfaces are continuously covered with a film of lubricant and are less subject to cutting action and corrosion than ordinary types of valves.

There is no danger of "freezing" no matter how long the plugs remain in one position.

There is a type of Nordstrom Valve in sizes from ½ in. to 24 in. for every kind of service. Write for Catalog 5.

MERCO NORDSTROM VALVE CO.

SUBSIDIARY OF THE MERRILL COMPANY

San Francisco
121 Second St.

Chicago
People Gas Bldg.

Cleveland
325 Engineers Bldg.

New Orleans
1501 Masonic Temple Bldg.

Houston
1315 Petroleum Bldg.

New York
11 W. 42nd St.

MERCO

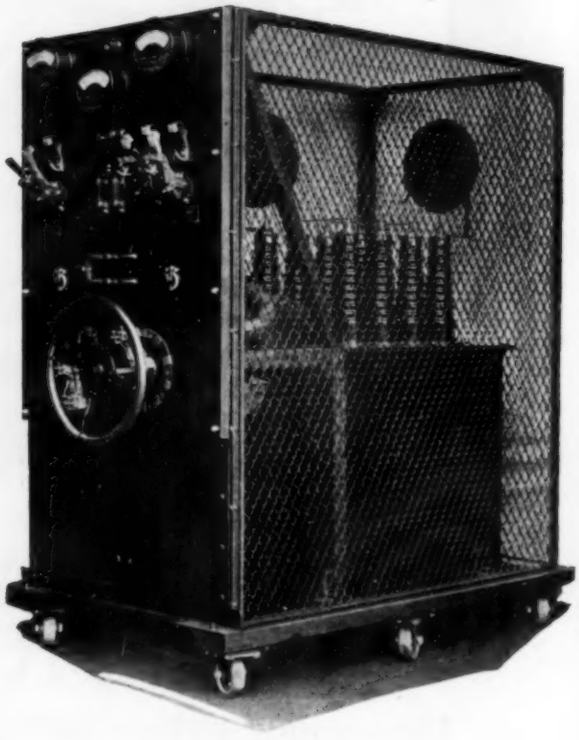
Merco Nordstrom PLUG VALVES

Agencies in Principal Cities. Factories at Oakland, Calif., and Belleville, N. J.

AMERICAN TRANSFORMER

TS-10A Test Set

for any conditions requiring the measurement of 500 to 50,000 volts with a considerable degree of accuracy



Ten leading laboratories have purchased this set

They are being used regularly to test many different materials and apparatus including compounds, oils and greases, molded sheet and cambric insulation, porcelain insulators, oil for transformers, coils and for every kind of electrical apparatus.

Details of TS-10A

TS-10A testing set is rated at 5 kv-a., 220-volt, 60 cycle, primary; 16500/33000/66000-3300/1650/825 volt secondary.

This set is designed to meet specifications which require testing of apparatus from 500 to 5000 volts; from 5000 to 20,000 volts; from 20,000 to 50,000 volts; and from 50,000 to 66,000 volts.

It consists of an oil-immersed, self-cooled, testing transformer, dial switch, auto type voltage regulator, primary main line switch, circuit breaker, pilot lamp, voltmeter and ammeter. The regulator consists of an auto transformer with ten 10% and ten 1% taps. The 10% taps are connected to one dial switch, the 1% taps to the other dial switch. Voltage is raised from zero to 100% in steps of 1% without interrupting the circuit.

This set is equipped with proper control so that it can be quickly and easily changed from one range to another.

There is no red tape to hinder you in the purchase of an American Transformer, or testing set. You can get exactly what you want and without delay. And more important, you get the benefit of the experience of a company that has this year made a considerable number of installations for engineers whose problems are similar to yours.

Tell us what you need for your present work. Write for Bulletins 1025-C, 1035-C and 1040-C.

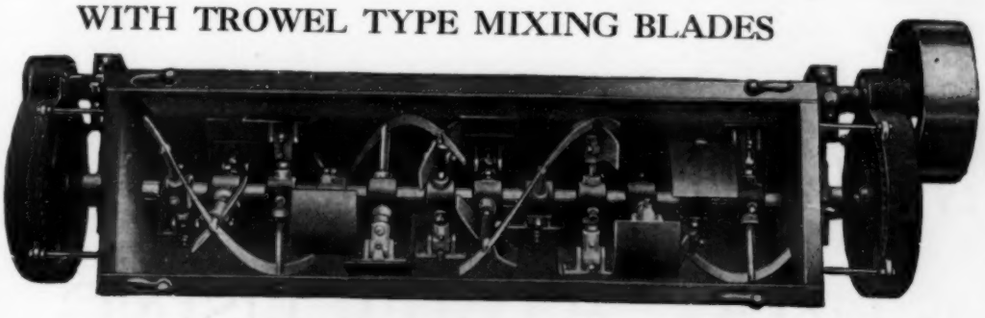
AMERICAN TRANSFORMER COMPANY
182 Emmet Street, Newark, N. J.

A special transformer for every industrial requirement

M I X E R S

ALL TYPES — ALL SIZES — FOR ALL PRODUCTS

WITH TROWEL TYPE MIXING BLADES



WITH STEAM-JACKETED BODY

WITH HARDWOOD or SPECIALLY TREATED BODY

A New Mixer for Thoroughness

For materials that are extremely difficult to mix or which have a tendency to ball up while being handled —dry colors, water paints, stucco preparations, clays, pulverized sugar, soda, etc. No lumps—no "balling up." Thorough disintegration and intimate blend. Replaces burr stones, cage mills, and other costly grinding mediums formerly used for mixing.

Tested for Strength

A strong, durable machine especially designed for use where it is desired to heat, boil or dry the materials during the process of mixing. This machine can be furnished with our regular efficient mixing mechanism or with the severe service mechanism with trowel type mixing blades. It is thoroughly tested to pass the Underwriters' Insurance requirements.

Will Not Rust or Corrode

For mixing salt, chemicals and other materials which have a tendency to corrode plain steel. The illustration shows the UNIQUE Mixer with wood casing but the machines can be heavily galvanized, made up of Monel-metal or otherwise specially treated according to requirements. Either our standard or special severe service mechanism can be used depending upon the nature of the materials to be mixed.

These and other UNIQUE Mixers with capacities ranging from ½ to 160 cubic feet, are shown in detail in Bulletin No. 32-A. We shall be pleased to send you a copy, on request.

An interest in UNIQUE Equipment entitles you to our complete engineering and advisory service.

UNIQUE

ROBINSON MFG. CO.

PAINTER STREET, MUNCY, PA.

MANUFACTURERS OF PROCESS EQUIPMENT

Crushers, Grinders, Pulverizers, Sifters, Mixers, Elevators and Conveyors

UNIQUE

Up!

Up!

Up!

His sales volume responded to

INDUSTRIAL ADVERTISING

LISTEN to this story of a business that pulled itself up by its own boot straps, the story of a manufacturer who defied the trend of general business and gained sales volume regardless.

From a minor position to recognized leadership by steady yearly gains, always exceeding the progress of the industry as a whole—that is what took place and how it was done is an open book.

It was a young business, making machinery supplies and small parts—sort of a line of industrial "notions"—just the type that might be thought too small to employ Industrial Advertising effectively. In the light of what happened, no one can tell this manufacturer that Industrial Advertising cannot be geared to a small business. That is just what he did—

Geared Industrial Advertising to His Business

At the outset the policy was established to specialize on worthwhile markets. Their buying habits were studied intently and a complete plan of Industrial Advertising and Selling was built around their needs. Thoughtful attention was devoted to the selection of industrial publications and the preparation of advertising copy. In team-work fashion both sales and advertising strategy were aimed at one thing—*Recognition by worthwhile buyers.*

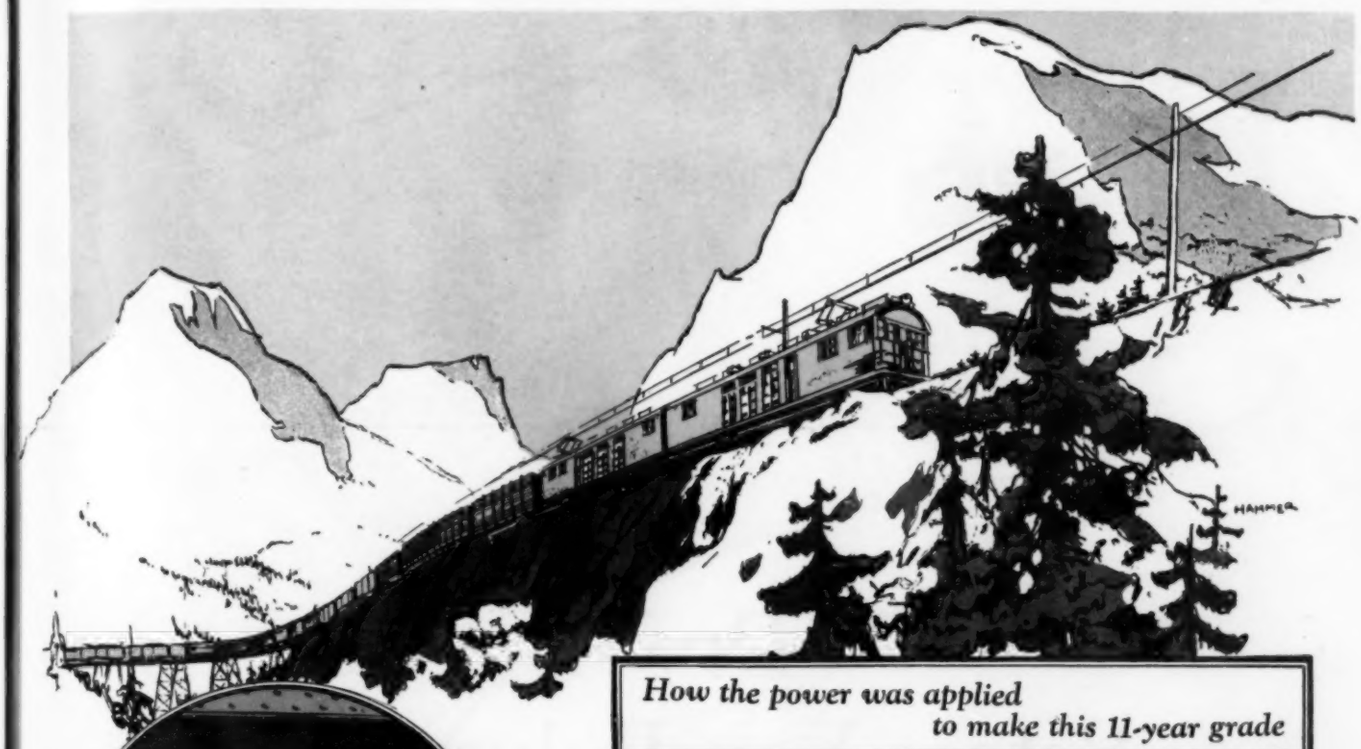
This recognition was found to be the straight line to larger sales volume. Tangible results were greater than a previous inquiry campaign had produced. A check of new buyers against McGraw-Hill subscribers showed that 80% were on both lists.

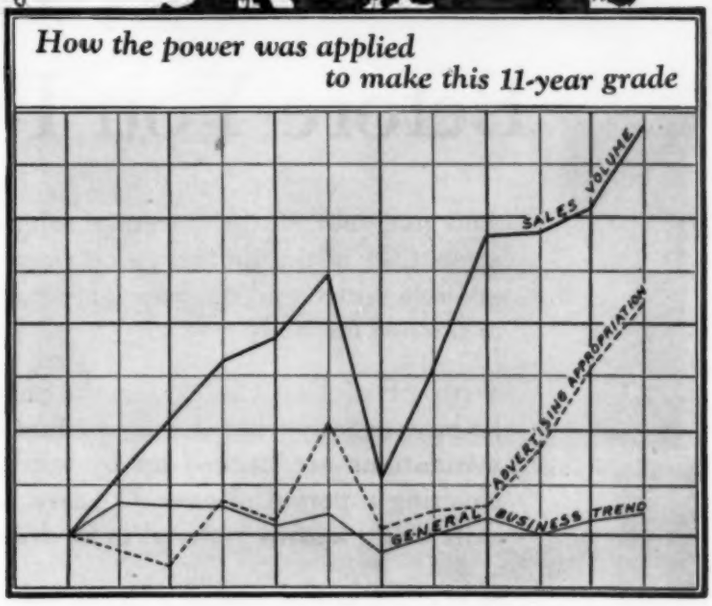
From each year's business came the wherewithal to produce next year's increase. Eight per cent of gross revenue appropriated for Industrial Advertising produced an average yearly gain in sales volume of nearly 30%. Only once did the manufacturer experiment with a reduced appropriation and this was the only period when he experienced reduced sales. Comparing the three curves of the chart shows that this manufacturer's growth was controlled not so much by general business conditions as by his volume of Industrial Advertising.

Industrial Marketing at Work

After studying hundreds of such successful cases as this, McGraw-Hill prepared its new book, "Industrial Marketing at Work." This book establishes *recognition* as the proper goal of industrial marketing and offers a practical method, in ten logical steps, for its accomplishment.

If your markets lie within any field of industry broader than your strictly local territory a McGraw-Hill representative will gladly discuss this study and present a copy to you or your advertising agency. For promptness, address your nearest McGraw-Hill office.





McGRAW-HILL PUBLISHING COMPANY, INC., NEW YORK, CHICAGO, PHILADELPHIA, CLEVELAND, ST. LOUIS, SAN FRANCISCO, LONDON. PUBLISHERS OF

McGRAW-HILL
Publications

Electrical
ELECTRICAL WEST
ELECTRICAL WORLD
ELECTRICAL MERCHANDISING

Construction & Civil Engineering
ENGINEERING NEWS-RECORD
CONSTRUCTION METHODS

Industrial
POWER
AMERICAN MACHINIST
INDUSTRIAL ENGINEERING
CHEMICAL & METALLURGICAL ENGINEERING

Catalogs and Directories
McGRAW-HILL ELECTRICAL ENGINEERING CATALOG
McGRAW-HILL ELECTRICAL TRADE CATALOG McGRAW CENTRAL STATION DIRECTORY
KEYSTONE COAL MINING CATALOG McGRAW ELECTRIC RAILWAY DIRECTORY
KEYSTONE METAL QUARRY CATALOG METAL QUARRY DIRECTORY
KEYSTONE COAL BUYERS CATALOG COAL FIELD DIRECTORY
BONBRIGHT SURVEY OF ELECTRIC POWER & LIGHT COMPANIES IN THE U. S.

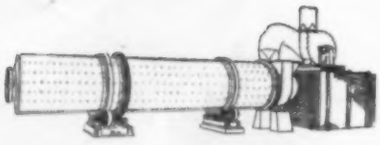
Radio
RADIO RETAILING

Transportation
BUS TRANSPORTATION
ELECTRIC RAILWAY JOURNAL

Mining
COAL AGE
COAL AGE NEWS
ENGINEERING & MINING JOURNAL

Overseas
INGENIERIA INTERNACIONAL
AMERICAN MACHINIST (EUROPEAN EDITION)

48,000 PAGES USED ANNUALLY BY 3,500 INDUSTRIAL ADVERTISERS TO HELP INDUSTRY BUY MORE INTELLIGENTLY



Dry
Before You Pulverize

And give yourself the margin of safety in your plant operation that is the difference between knowing what you are up against, and not knowing what to expect from new or untried methods.

With a Ruggles-Coles Dryer, the purchaser knows before he buys exactly what it will cost him to operate. Recommendations are backed up by actual operating records covering a period of over 30 years, and covering practically every known material to be dried.

While the initial cost of a dryer may seem high, the cost of drying is definitely known, operating conditions are accurately controlled, and no product is wasted by untried methods.

Write for information

Ruggles-Coles Engineering Company
of Hardinge Company, Inc.
York, Pa.

120 Broadway
New York, N. Y.

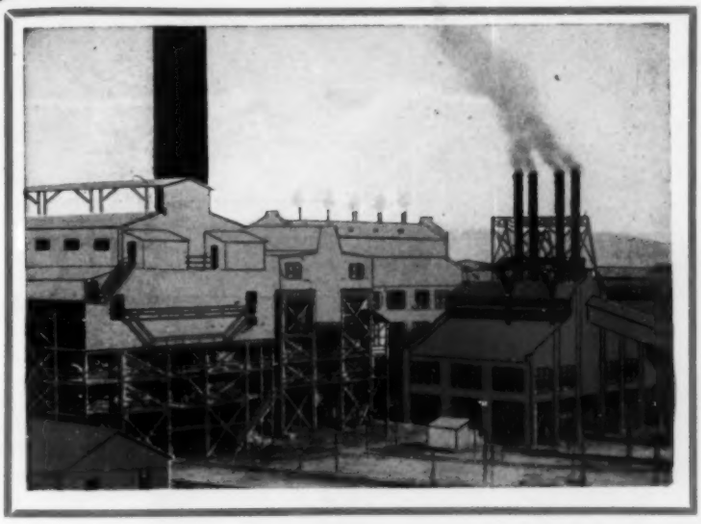
Continental Bank Bldg.
Salt Lake City

"Ruggles-Coles" Dryers

CARBONIZING COATING
TRADE MARK
FOR IRON AND STEEL

Made by the makers of

Galvanum
FOR GALVANIZED IRON



CARBONIZING COATING
TRADE MARK
FOR IRON AND STEEL

For more than 40 years, Carbonizing Coating has been helping plant maintenance men protect their iron and steel structures. It gives a 3 point economy:

1. In numerous instances, it has given from 7 to 10 years' service—this means less frequent repainting.
2. It lengthens the life of the structure—durability is the first essential of economy.
3. Its easy working and free spreading qualities reduce paint and labor costs—and labor represents three-quarters of the cost of every paint job.

Carbonizing Coating and Galvanum each hold a distinct place in industrial maintenance programs—*Galvanum* as the outstanding paint for galvanized iron surfaces; *Carbonizing Coating* for iron and steel work.

Write us for a list of plants where bothersome rust and corrosion conditions are being held under control by maintenance men who *specify and insist on getting Carbonizing Coating.* This may mean a lot to you!

Uses—

Steel Buildings . . . Fans . . . Cranes . . . Conveyors . . . . . Penstocks . . . Tanks . . . Bridges . . . Towers . . . Cars . . . Hoists . . . Blowers

ESTABLISHED 1888
GOHEEN CORPORATION OF NEW JERSEY
PAINT ENGINEERS SINCE 1888

Colors—

Black . . . Olive Green . . . Bottle Green . . . Red . . . Maroon . . . Steel Gray . . . Battleship Gray . . . White and special colors supplied on order.

GOHEEN CORPORATION

Main Office and Plant
Newark, N. J.

of New Jersey

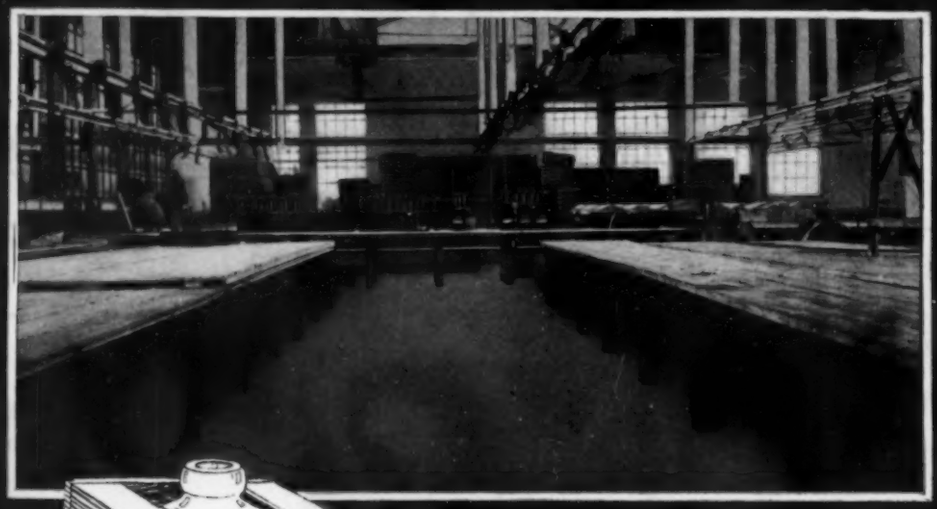
New York City Office
331 Madison Ave.

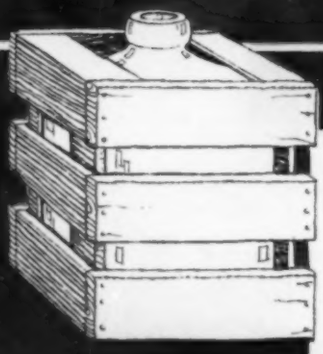
Paint Engineers Since 1888

Galvanum
FOR GALVANIZED IRON

This is the one outstanding paint that sticks to galvanized iron and preserves its life indefinitely. When you use Galvanum there is no need of using any acid wash, special primer, or weathering. Color Cards and full detailed description with quotation sent on request.

ACID RESISTANT





AN acid bath, added to the regular hard service plant floors receive, sets up a standard no ordinary flooring can meet.

For such conditions Johns-Manville has developed Acid Resisting Industrial Flooring. This remarkable flooring specification stands acid like a laboratory top—yet is strong enough to stand almost unlimited wheel wear and shock as well.

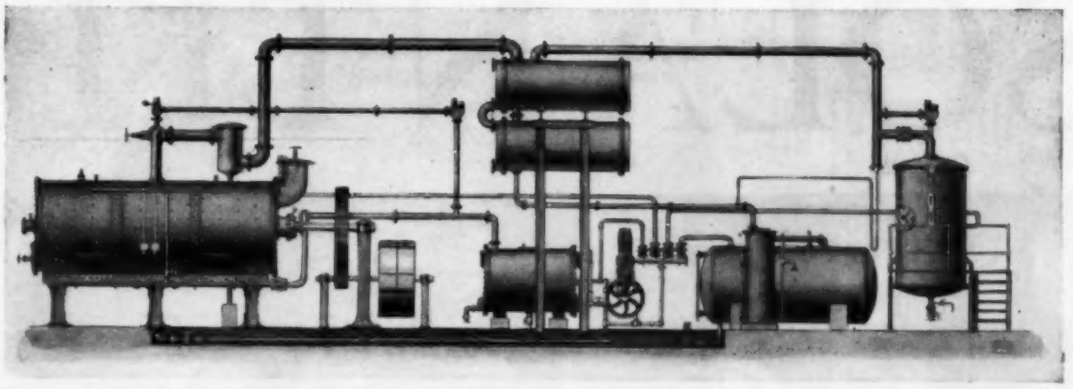
Use it in laboratories, storage battery plants, dye works, pickling rooms—wherever the floors are subjected to corrosives and trucking. It will give you lasting service and pare down upkeep costs to the lowest figure, for it asks little or nothing in the way of repairs.

Asbestos and its allied products
INSULATION
BRAKE LININGS
ROOFINGS
PACKINGS
CEMENTS
FIRE PREVENTION PRODUCTS

The photo shows Industrial Flooring installed in battery assembling room of Willard Storage Battery Co., Cleveland, Ohio.

JOHNS-MANVILLE
Industrial Flooring

JOHNS-MANVILLE CORPORATION, 292 MADISON AVENUE AT 41ST STREET, NEW YORK
BRANCHES IN ALL LARGE CITIES
FOR CANADA: CANADIAN JOHNS-MANVILLE CO., LTD., TORONTO



"SCOTT" EXTRACTION PLANT AS APPLIED TO WET RAW MATERIALS—ANIMAL WASTE, FISH AND OTHER RESIDUES

SCOTT'S EXTRACTION

Greater Yields

Whenever Scott's engineers design, build and install Extraction equipment high yields are assured.

"Scott" plants are in successful operation on a large variety of materials. They deal with such products as oleaginous seeds, nuts, beans; with animal and fish waste, offal, etc.; with bones, Fuller's Earth and numerous other materials.

Ninety years ago Scott began their work of process equipment improvement. Today it has become an organization of seasoned experts in many lines. They will gladly show you, without obligation, how it is possible, with Scott's equipment, to get greater yields and cut production costs.

ERNEST SCOTT AND COMPANY

Chemical Process Engineers
for more than 90 years

Fall River, Mass.

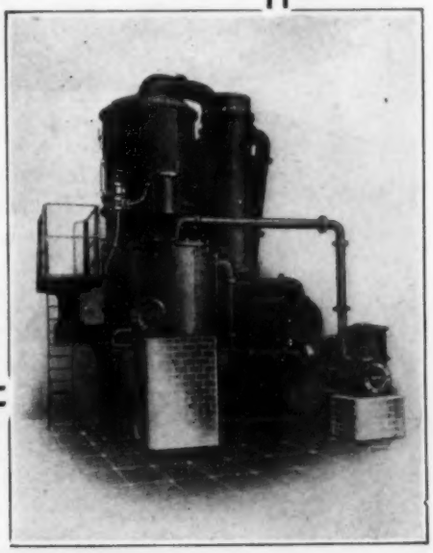
SCOTTS

In these and other industries Scott Equipment has an unparalleled record of profit building performance:

Alkalies
Alcohol
Artificial Leather
Artificial Silk
Beet Sugar
Chemicals
Dyestuffs and Intermediates
Edible Oils
Food Products
Garbage Reclamation
Glucose and Starch
Meat Packing
Paper and Pulp
Petroleum Refineries
Rubber
Soap and By-Products
Tar Products
Fertilizers
Fishing Industry
Textiles

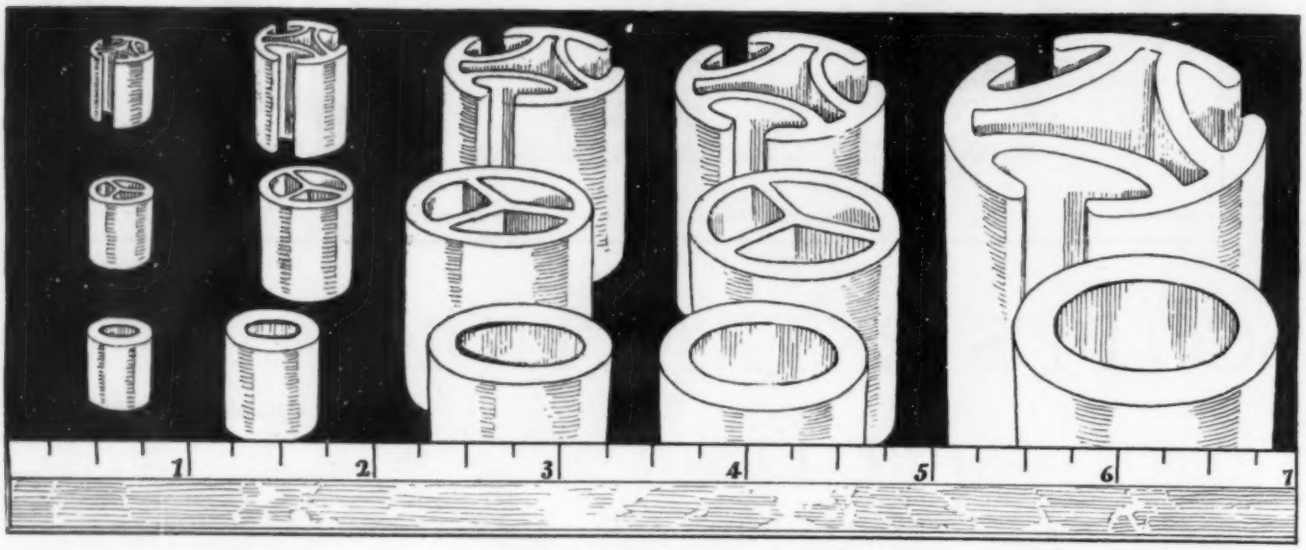
SCOTT VACUUM DISTILLING PLANT

For producing distilled water, fractionating naptha and other volatile solvents.



SCOTTS

ISOLANTITE



The Correct Tower Packing

Designed to meet *your* requirements

Made in a wide range of sizes and designs for general and special purposes.

Large Contact Surface
Great Free Space
Corrosion Resistant
Strong Mechanically
Permanent

Write for samples and also our engineering report on Isolantite Tower Packings. Place your tower filling problems before us, and we will gladly co-operate with you in solving them.

ISOLANTITE COMPANY *of* AMERICA

New York Sales Representative
551 Fifth Ave., NEW YORK CITY

It Pays to Keep a KEWAUNEE LABORATORY Busy on Your Manufacturing Problems

—Cutting Costs
—Improving Products
—Maintaining Standards
—Utilizing By-Products

A Kewaunee Laboratory will help you to accomplish these four objects. It will help make your plant more efficient. It will help make your product more certain, stable, uniform. It will help you to avoid expensive mistakes.

We shall be glad to correspond with you regarding your laboratory equipment and to give you the benefit of our experience. Ask for details of our free Engineering Service. Address all inquiries to the factory at Kewaunee.

Kewaunee Mfg. Co.
LABORATORY FURNITURE EXPERTS
C. G. Campbell, Treas. and Gen. Mgr.
106 Lincoln St., Kewaunee, Wis.

Chicago Office: 25 E. Jackson Blvd., 1511 Kimball Bldg.
New York Office: 70 Fifth Avenue
Offices in Principal Cities

Chemical Laboratory Desk and Hood No. 15025

RESEARCH MARK OF 1927 INDUSTRY

Laboratory Methods Rule Today as Combination Did 30 Years Ago.

BY EDWIN G. NICHOLS.

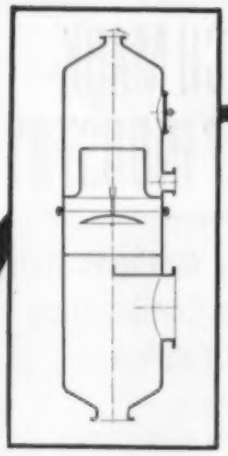
How does a veteran investment banker regard this era of changing financial and industrial conditions? Ask Edward P. Russell, senior partner of the stock exchange firm of Russell, Brewster & Co., and he will tell you how things have altered and how it is necessary now to take new factors into account in investing money.

"This is the era of industrial research, just as thirty years ago was the era of industrial combination," said Mr. Russell today. "It is the age of the laboratory and of laboratory methods. If you are investing money, buy the securities of those concerns which employ constant research of the most modern, scientific sort, preferably the leaders in their respective fields of industry. Reduction of costs is the urge and problem of the day. Great concerns must pay the current prices for raw materials. These cannot be reduced by ingenuity of management. It is not the fashion to cut wages, for it is realized that our great domestic market rests upon well remunerated labor. Reduction in costs must come through research, chemistry, improved machinery, better operating methods, avoidance of waste, and utilization of by-products which formerly were thrown away.

"It is reasoning such as this which has led shrewd investors who desired to put their money into the steel business to buy United States Steel, or in the automobile industry to buy General Motors, or in the farm machinery business to buy International Harvester, or as an example of effective methods of research, Union Carbide and Carbon."

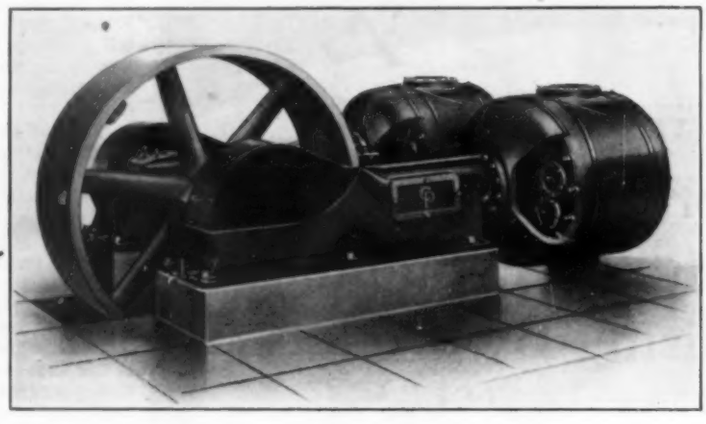
From the Chicago Daily News

We also build laboratory furniture for any purpose to architects' or owners' designs.



Cross Sectional View Chicago - Byer Barometric Condenser Head

CONDENSERS *and* VACUUM PUMPS



CHICAGO-BYER (Patented) Barometric Condensers and CP Simplate Valve equipped Vacuum Pumps have proven their efficiency and dependability as individual units in existing plants. They are now quite generally specified for new complete units by those having had experience with them.

The Chicago Pneumatic Tool Company gladly accepts the responsibility of maintaining satisfactory vacuum with CP equipment.

CP Engineers have had a wide experience in connection with vacuum plants. They can probably be of service to you if you have a vacuum problem to solve. They will offer positive advice—there will be no experimenting to do.

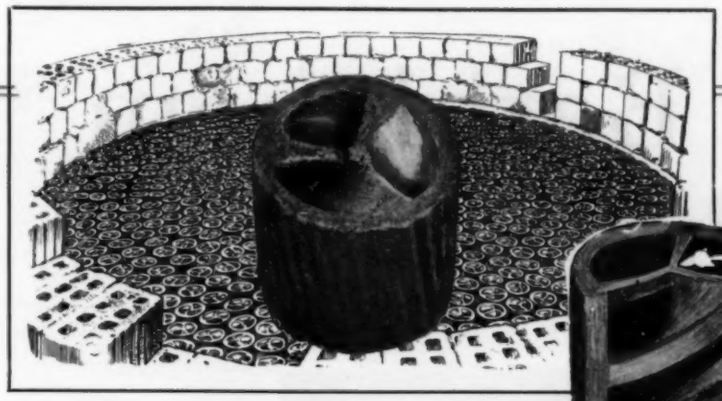
Write for Bulletins 716 and 717 as a preliminary step in the solution of your vacuum pump or condenser problems.

Chicago Pneumatic Tool Co.

Sales and Service Branches all over the world

CV-25

6 East 44th Street New York, N. Y.



No hole at axis:

Large Surface

Large Free Space

They *must* take the spiral paths

ALL the liquids and gases passing through the tower have to travel the three separate spiral passages. The tile pack 55 to the cubic foot and give 36 square feet of surface and 60% free space. This affords very excellent baffling and scrubbing without excessive gas friction and practically eliminates any possibility of gas channels forming in the packing.

Large surface exposed to liquids and gases creates greater tower efficiency wherever heat transfer from gas to liquid is required; where gases are absorbed by liquids or expelled from liquids by the action of heat.

Triple Spiral Tower Packing Tile measure up to this high standard of efficiency. Write us for a sample.

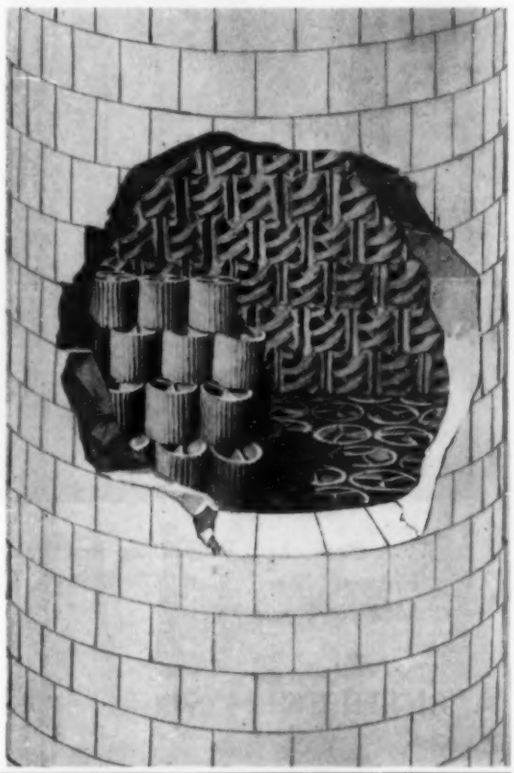
6 Maximum Efficiency POINTS

1—Greatest possible scrubbing surface and free space.
2—Simple and durable construction.
3—Self supporting, with no appreciable lateral pressure.
4—Easily packed in square or round towers.
5—Good distribution of the gas and liquid.
6—Low initial cost.

Some Users of Triple Spiral Tile

Universal Oil Co.
Freedom Oil Works
•Standard Oil Co. (N. J.)
Pure Oil Co.
Rio Grande Oil Co.
Carter Oil Co.
Imperial Oil Refineries
•Shell Co. of California
Federal Gasoline Co.
Sinclair Oil & Gas Co.
Humble Oil Refinery
•Empire Oil & Refining Co.
•C. F. Braun & Co.
Moody Corporation
Henry L. Doherty Co.
•General Chemical Co.
Ozark Chemical Co.
•Central Chemical Co.
•Southern Sulphur & Acid Co.
•Grasselli Chemical Co.
Reliance Fertilizer Co.
American Cyanamid Co.
Alabama Chemical Co.
Read Phosphate Co.
Tupelo Agricultural Corp.
Home Guano Co.
•International Agricultural Corp.
Pelham Phosphate Co.
Barker Chemical Co.
Georgia Fertilizer Co.
•United Zinc Smelting Corp.
Powers-Weightmen-Rosengarten Co.
Pittsburgh Plate Glass
Sloss-Sheffield Steel & Iron Co.
Smith Gas Engineering Co.
Atlas Powder Co.
Baur Carbonic Co.
Hegeler Zinc Co.
Sevel Sayer Co.
Acme Steel Co.
J. C. Hubinger Co.
Mond Nickel Co. Ltd.
Braden Copper Co.
Bakelite Corp.
Lever Bros. Co.
Solvay Process Co.
Chas. Lennig & Co.
U. S. Metals Refining Co.
Barber Asphalt Co.
Mechling Bros. Chemical Co.
F. J. Stokes Machine Co.
•United Lead Co.
Commercial Pigments Co.
Sharp & Dohme
Ansul Chemical Co.

*Repeat Orders

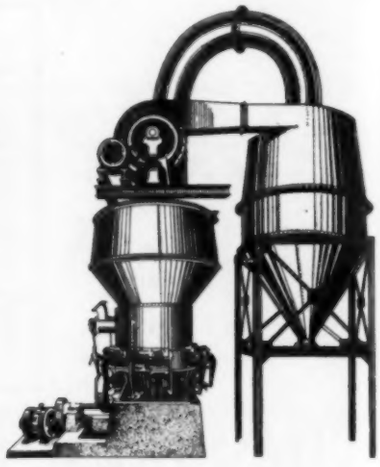


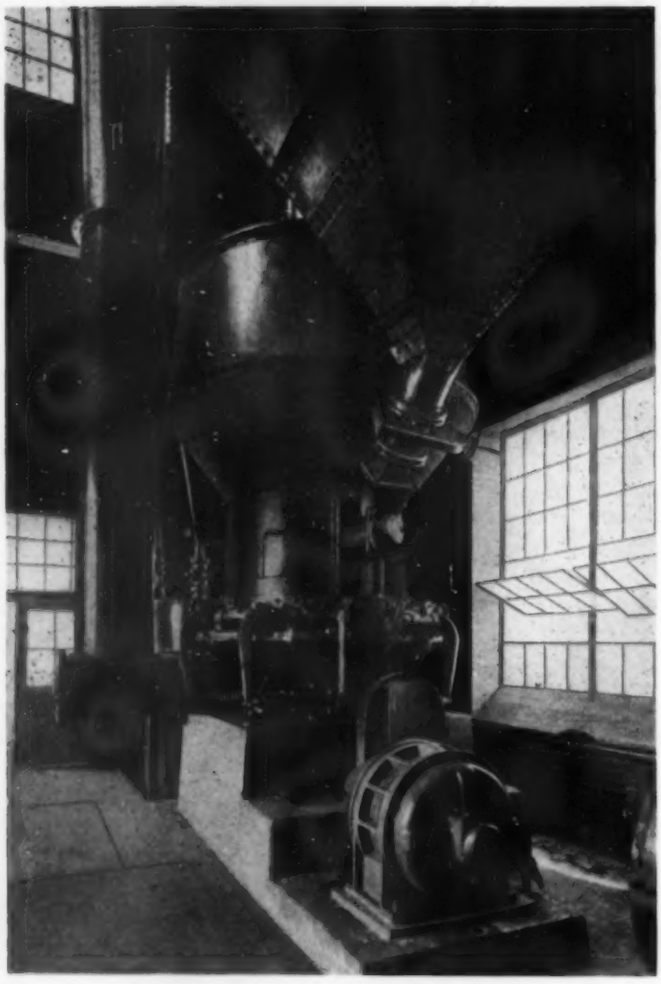
Chemical Appliances, Inc.

420 Lexington Ave., New York

Improve Your Tower By Using TRIPLE SPIRAL TOWER PACKING

The Bethlehem Pulverizer





A Bethlehem Pulverizer installation in the Pressed Steel Car Company's Plant at McKees Rock, Pa.

THE Bethlehem Pulverizer has solved the fine grinding problem by increasing production and reducing power consumption and operating costs to a minimum.

The Bethlehem Pulverizer is a self-contained unit in that it not only grinds the material but delivers it, without the use of conveyors or elevators, direct to storage bins.

It will grind a wide range of material to any degree of fineness up to 325 mesh and the rate of production and degree of fineness of the finished product can be controlled within extremely close limits.

A copy of our new catalog describing the Bethlehem Pulverizer in detail will be sent on request

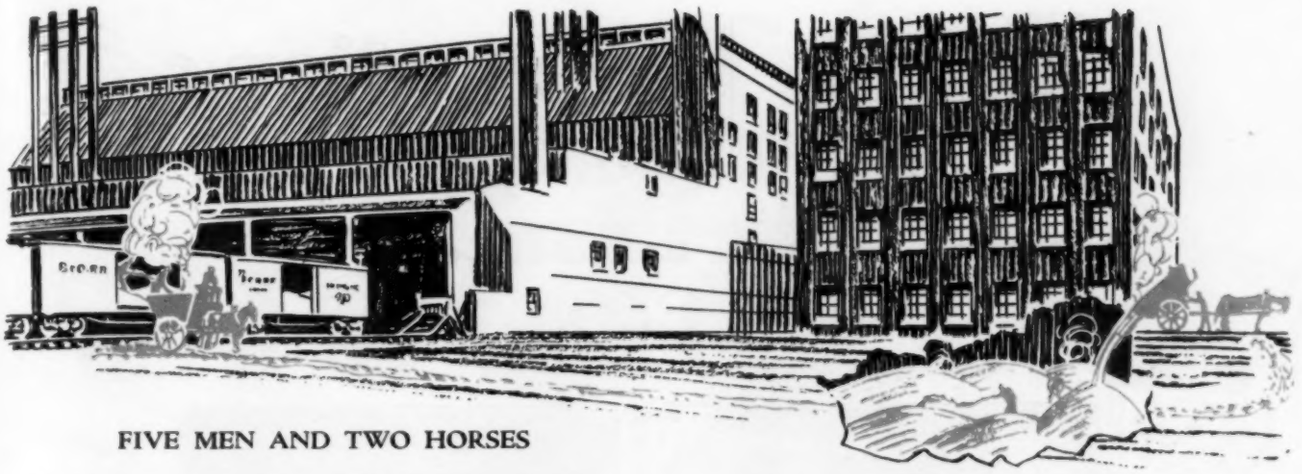
BETHLEHEM STEEL COMPANY, *General Offices:* BETHLEHEM, PA.

District Offices:

New York Boston Philadelphia Baltimore Washington Atlanta Pittsburgh Buffalo
Cleveland Cincinnati Detroit Chicago St. Louis San Francisco Los Angeles Seattle Portland

Bethlehem Steel Export Corporation, 25 Broadway, New York City, Sole Exporter of Our Commercial Products

BETHLEHEM



FIVE MEN AND TWO HORSES

Conveying Materials

Direct from Car to Storage

With HOLLY *Pneumatic Conveyors*

The remarkable success of Holly Pneumatic Conveyors in a wide variety of industries should interest every manufacturer seeking a rapid, dependable and economical method of handling loose bulk materials.

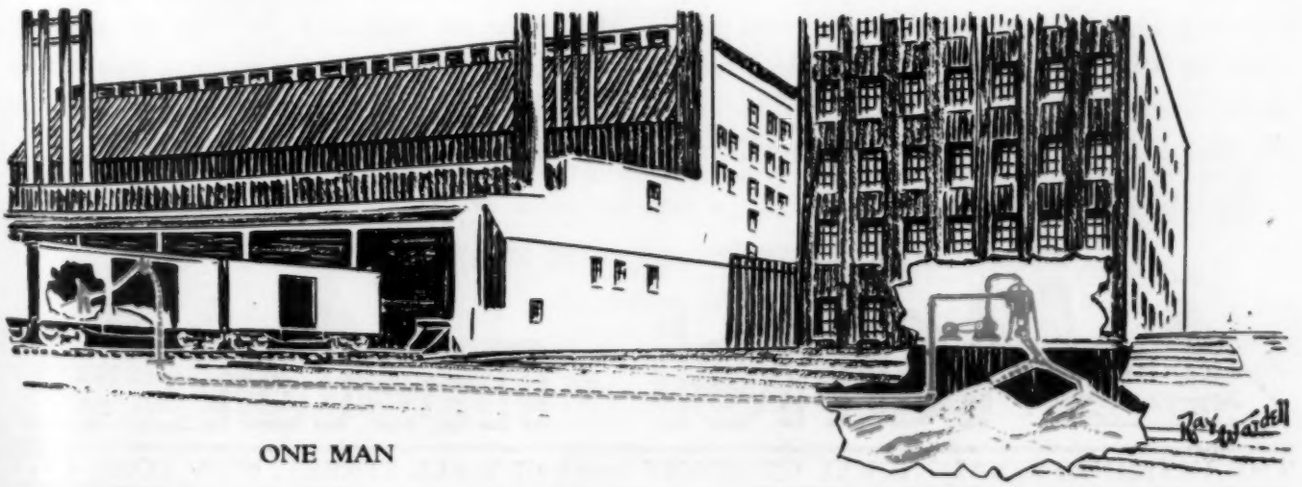
Compare these pictures. One man with a Holly suction system can do the work of five men and two horses, in any sort of weather and without dust or waste. There are many other advantages.

Holly engineers will welcome the opportunity to show you the advantages of this system in your plant. Have you a copy of our Bulletin HCC2?

Highly Desirable for

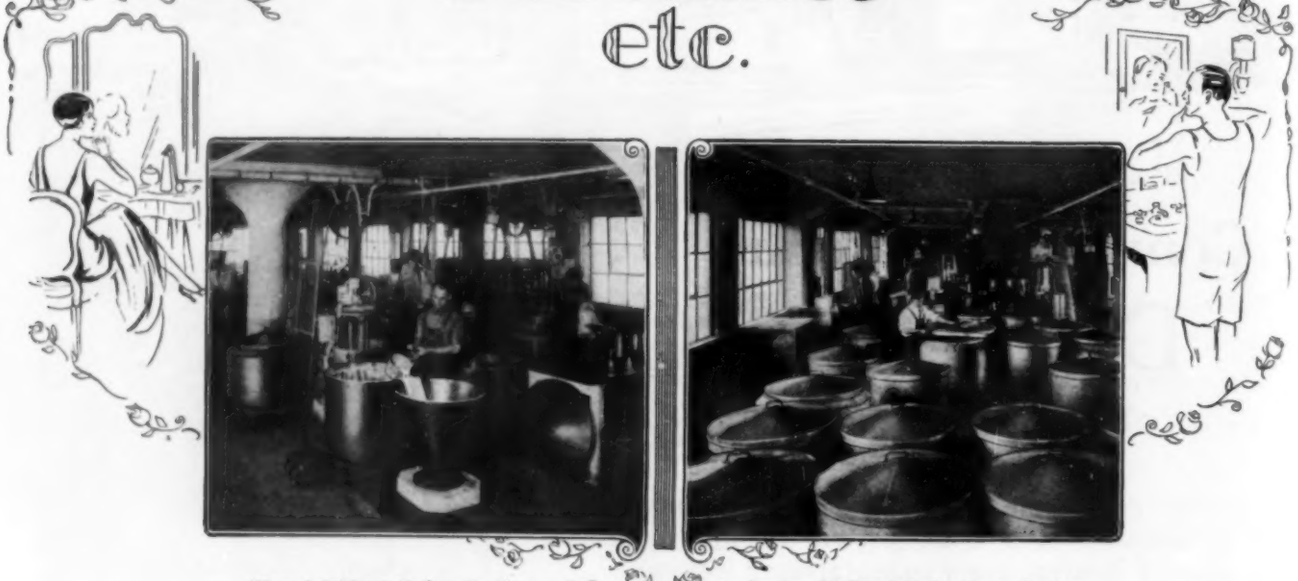
Cement	Malt
Chemicals	Nuts
Clay	Ores
Cocoa	Phosphate Rock
Coal	Pigments
Coke	Poisonous Materials
Copra	Salt
Cotton Seed	Sand
Drugs	Scrap
Dyes	Seeds
Fertilizers	Soda Ash
Flue Dust	Sugar
Grain	Wood Chips

HOLLY PNEUMATIC SYSTEMS, INC.
96 East 45th Street, New York, N. Y.



ONE MAN

Toilet Preparations
Shaving Creams
Perfumes
etc.



View of California Perfume Co. plant at Suffern, N. Y., showing some of the jacketed and unjacketed Monel Metal containers with covers, mfd. by THE FALSTROM CO. of Passaic, N. J. Monel Metal fitted "Lightnin" Portable Mixers may be seen in background.

Another view of California Perfume Co. In this plant there are many of these Monel Metal containers, some of which are jacketed for cooling—all are fitted with Monel Metal covers and were made by THE FALSTROM CO. Containers are 32" in diameter and 28" high.

—*free from impurities when made in* Monel Metal Equipment

AIDS to beauty are big profit-makers when they are pure and uncontaminated. But if the manufacturer permits the slightest spoilage to occur, the batch—and perhaps, his reputation—are ruined.

The California Perfume Co. plays safe by handling its delicately colored and scented products in Monel Metal containers. It insures them against contamination and discoloration. For Monel Metal resists corrosion, it will not rust, and it is the most easily cleaned of all available metals. It has toughness and strength to resist use and abuse. It lasts for years in hard service, even where abrasive and corrosive materials are constantly handled.

If you are the manufacturer of a product that must be zealously guarded all through your plant, you will want to know more about Monel Metal. Ask your regular equipment manufacturer or write direct to us.

SEND FOR "LIST B" OF MONEL METAL & NICKEL LITERATURE

Monel Metal is a technically controlled Nickel-Copper alloy of high nickel content. It is mined, smelted, refined, rolled and marketed solely by The International Nickel Company. The name "Monel Metal" is a registered trade mark.

MONEL METAL — Monel metal — MONEL METAL

THE INTERNATIONAL NICKEL COMPANY (INC.), 67 WALL STREET, NEW YORK CITY

For Severe Service—"VULCALOCK" Rubber Lined Steel Pipe and Fittings

The Goodrich Rubber-lined Relinable Shut-off Valve is ideally fitted for assembly with "Vulcalock" rubber-lined steel pipe and fittings. Made with bronze body for corrosives, and iron body for abrasives. It is always tight, requires no packing, and can be easily and inexpensively relined.

GOODRICH rubber-lined flanged steel pipe, with rubber-lined standard elbows, tees, Y's, and crosses, is now available in pipe sizes from 1¼" up.

The production of this pipe is based on the Vulcalock process, by which it is possible to attach soft rubber directly to steel, with an adhesion which is practically integral.

For resistance to corrosion, the lining is Goodrich Acidseal in a standard ⅛" thickness for all pipe sizes.

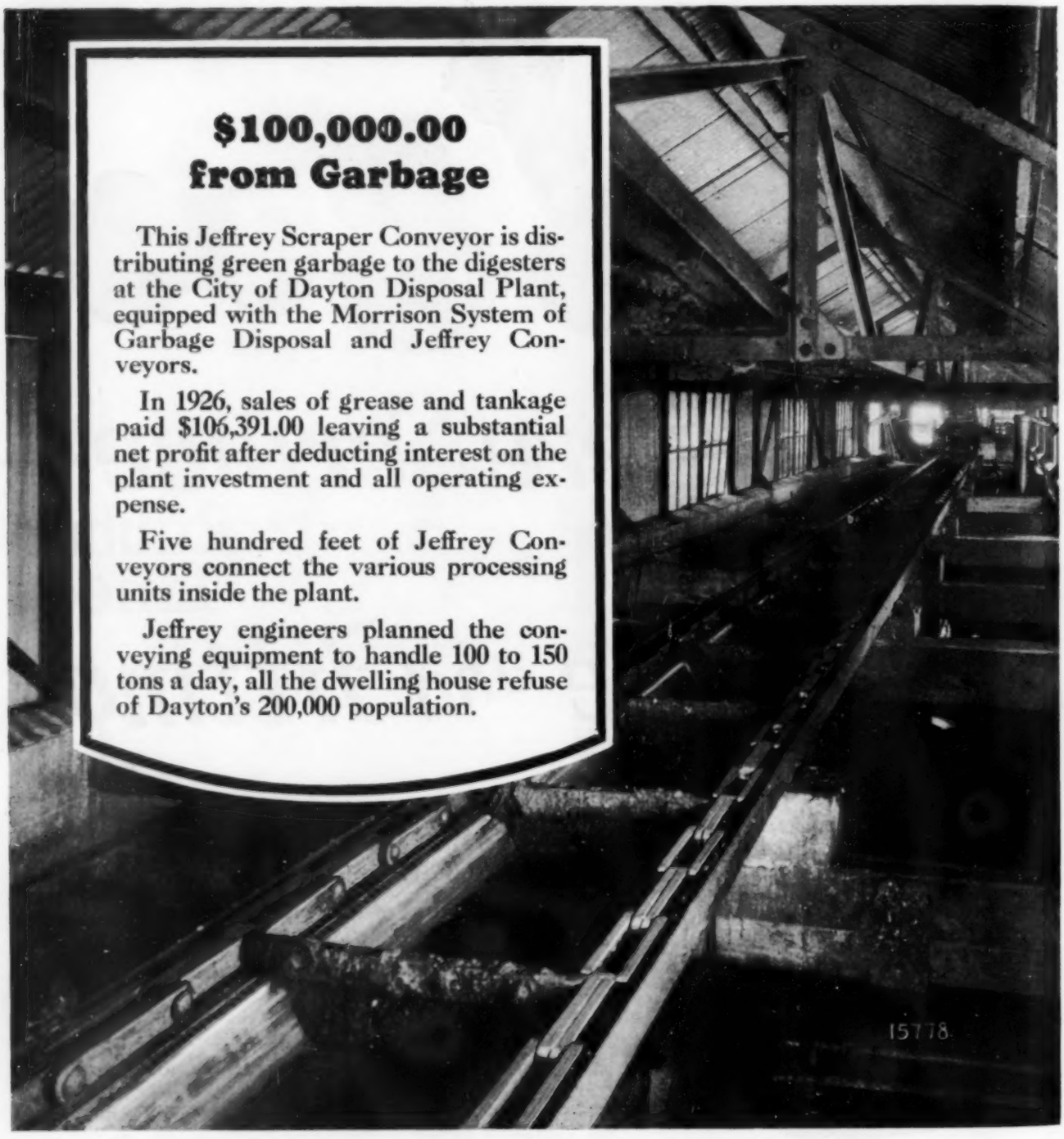
For abrasive service, Goodrich Armorite is applied in either of two standard thicknesses: ⅛" or ¼".

Hard rubber lining can be furnished, instead of the regular soft rubber, for handling certain corrosives too strong for soft rubber.

If your operations include the handling of corrosive or abrasive fluids, write for Bulletins 9780 and 9785.

THE B. F. GOODRICH RUBBER COMPANY
Established 1870 Akron, Ohio

Goodrich Rubber Products for the Process Industries



$100,000.00 from Garbage

This Jeffrey Scraper Conveyor is distributing green garbage to the digesters at the City of Dayton Disposal Plant, equipped with the Morrison System of Garbage Disposal and Jeffrey Conveyors.

In 1926, sales of grease and tankage paid $106,391.00 leaving a substantial net profit after deducting interest on the plant investment and all operating expense.

Five hundred feet of Jeffrey Conveyors connect the various processing units inside the plant.

Jeffrey engineers planned the conveying equipment to handle 100 to 150 tons a day, all the dwelling house refuse of Dayton's 200,000 population.

The Jeffrey Manufacturing Company

909-99 North Fourth St., Columbus, Ohio

New York, Buffalo, Rochester, N. Y., Philadelphia, Pittsburgh, Scranton, Pa., Boston, Cincinnati, Cleveland, Detroit, Chicago, Charleston, W. Va., Milwaukee, St. Louis, Denver, Salt Lake City, Los Angeles, Birmingham, Charlotte, N. C., Montreal

50 YEARS OF SERVICE TO INDUSTRY

JEFFREY

MATERIAL HANDLING EQUIPMENT

Jeffrey Products

Elevators Conveyors
Portable Loaders
Coal and Ashes Handling Equipment
Skip Hoists
Chains and Attachments
Sprocket Wheels — Gears
Crushers—Pulverizers
Sand and Gravel Handling, Washing and Screening Equipment
Locomotives
Coal Mine Equipment
Tipple Equipment
Ventilation Fans

At 154 Ogden Avenue . . .

Jersey City, N. J.

KOVEN

ON THE brow of the Palisades, overlooking the City of Hoboken, lower Jersey City and the Hudson River, is located the main office and manufacturing plant of L. O. Koven and Brother, Inc.

This manufacturer of Chemical and Process Equipment has grown from one small building to a group of 6 covering more than 30 acres in the space of one man's active business lifetime—40 years. In addition to our administration building where the executive offices, engineering department, and drafting room is located, we maintain our own pattern shop, plate steel shop, complete machine shops, riveting, welding, galvanizing and assembling shops.

The Koven organization is geared to build one simple container, or render a manufacturing service to a sales organization requiring a line of miscellaneous Chemical and Process Equipment.

KOVEN
33 types of PROCESS EQUIPMENT

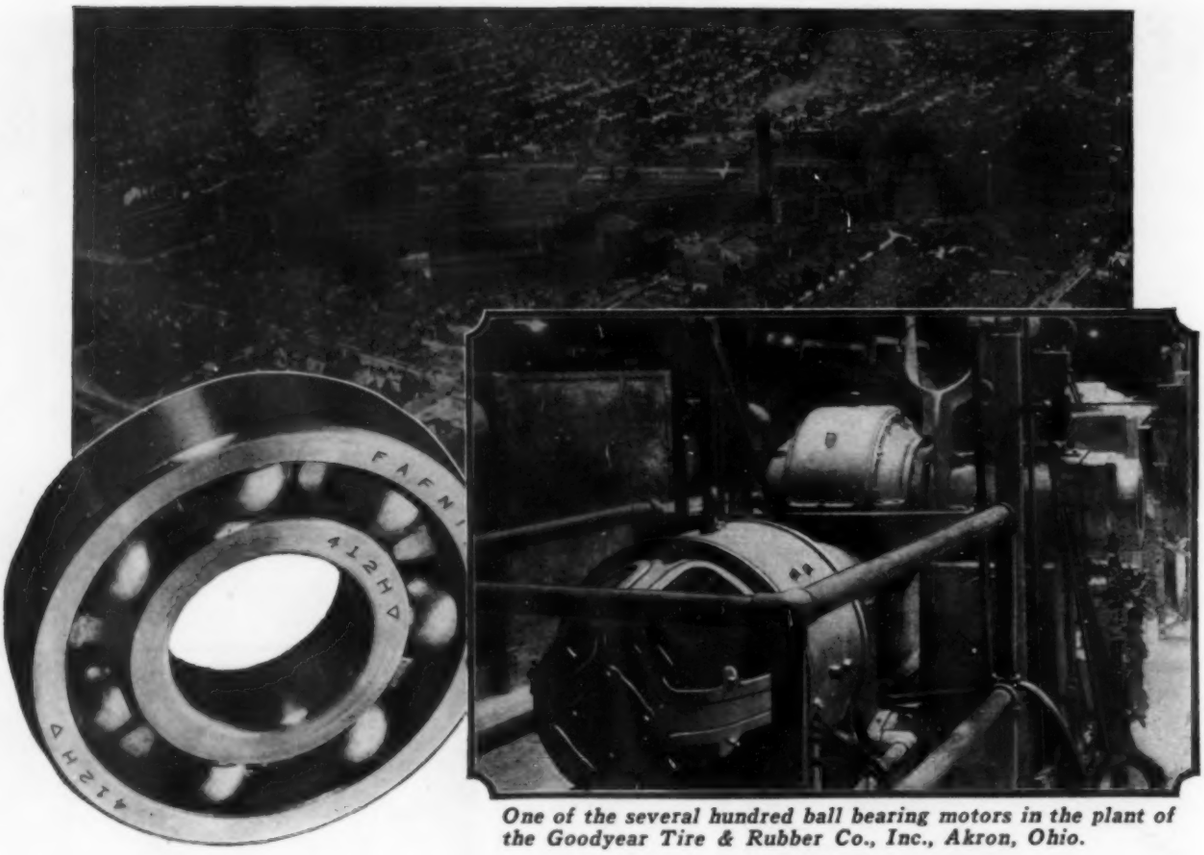
In the solving of equipment problems for the Process Industries, we have handled thousands of individual cases—some needing only one machine, others requiring a regular manufacturing service. These jobs classify themselves into 33 types which represent more than 400 designs. Submit your machinery needs to us. We will be glad to give you the benefit of our wide experience and estimate on your requirements.

Put your equipment problems up to Koven. You will find here the "brain power, machine power, man power and process-sense," so necessary for a satisfactory job.

Write today, sending an outline of your needs so that we can arrange a meeting with you.

L. O. KOVEN & BROTHER, INC.
154 Ogden Avenue
Jersey City, N. J.

DESIGNERS ENGINEERS **L. O. KOVEN & BROTHER, Inc.** FABRICATORS to the PROCESS INDUSTRIES



One of the several hundred ball bearing motors in the plant of the Goodyear Tire & Rubber Co., Inc., Akron, Ohio.

Goodyear endorses Ball Bearings

AN endorsement from Goodyear is an endorsement indeed!

Still, Goodyear's enthusiastic endorsement of ball bearings is deserved. Of the 100 *ball bearing* motors that were installed in 1918—all have been running continuously ever since—night and day. *Yet no repairs have been needed.*

As Mr. Philip C. Jones, Electrical Engineer of the Akron, Ohio plant puts it: ". . . with grease-filled ball bearings, we find we eliminate a lot of trouble, as well as diminish our oiling expense."

THE FAFNIR BEARING COMPANY, NEW BRITAIN, CONN.

Makers of high-grade ball bearings—the most complete line of types and sizes in America

EUROPEAN AGENT:

Benjamin Whittaker, Ltd., Aldwych House, London W.C.2, England

FAFNIR

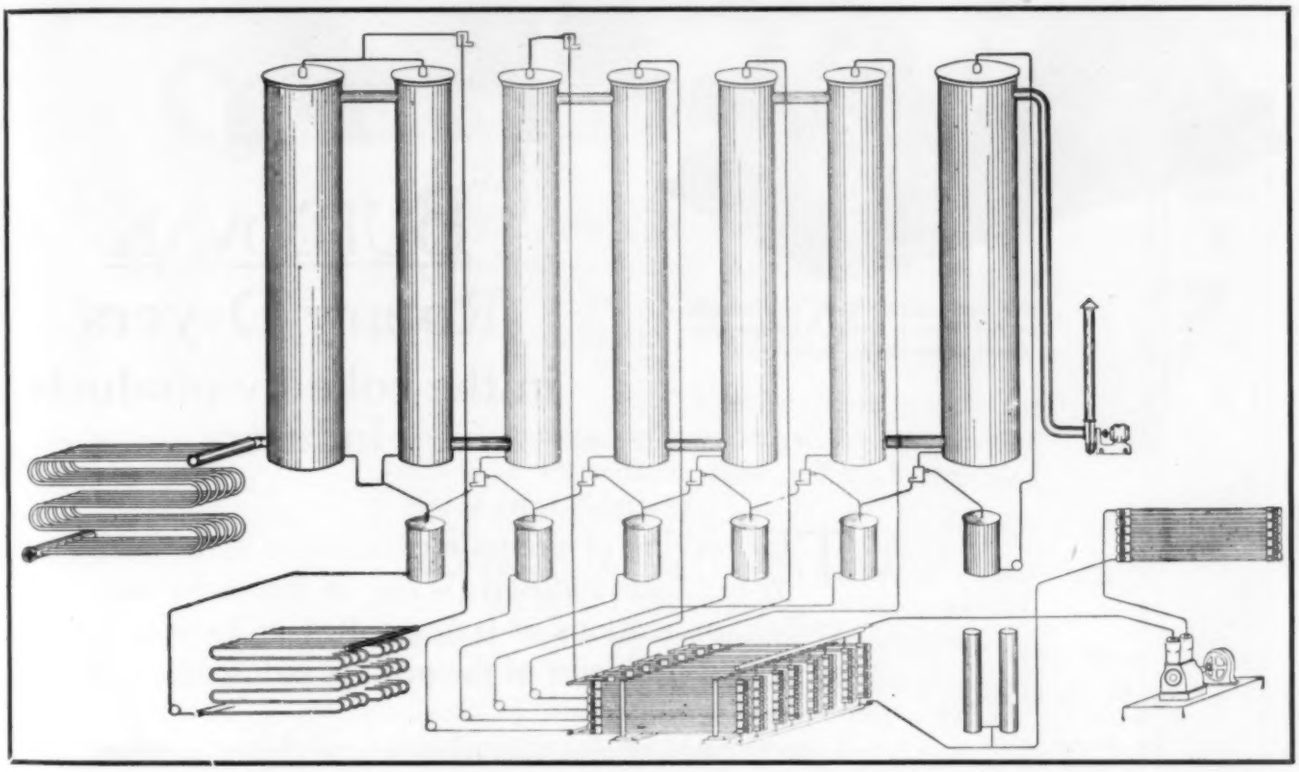
BALL BEARINGS

Molybdenum steel throughout IN BOTH RINGS AND BALLS

Nitric Acid from Ammonia!

Typical Absorption Equipment for Toniolo's Patented Process using Refrigeration.

Small Tower Space
High Strength Acid
High Recovery
Small Power Consumption
No Alkaline Absorption



EQUIPMENT

ASCOLOY (Chromium Iron Alloy) by Allegheny Steel Company
FABRICATION by Lancaster Iron Works

REFRIGERATION by York Manufacturing Company
INSULATION by Johns-Manville Corporation

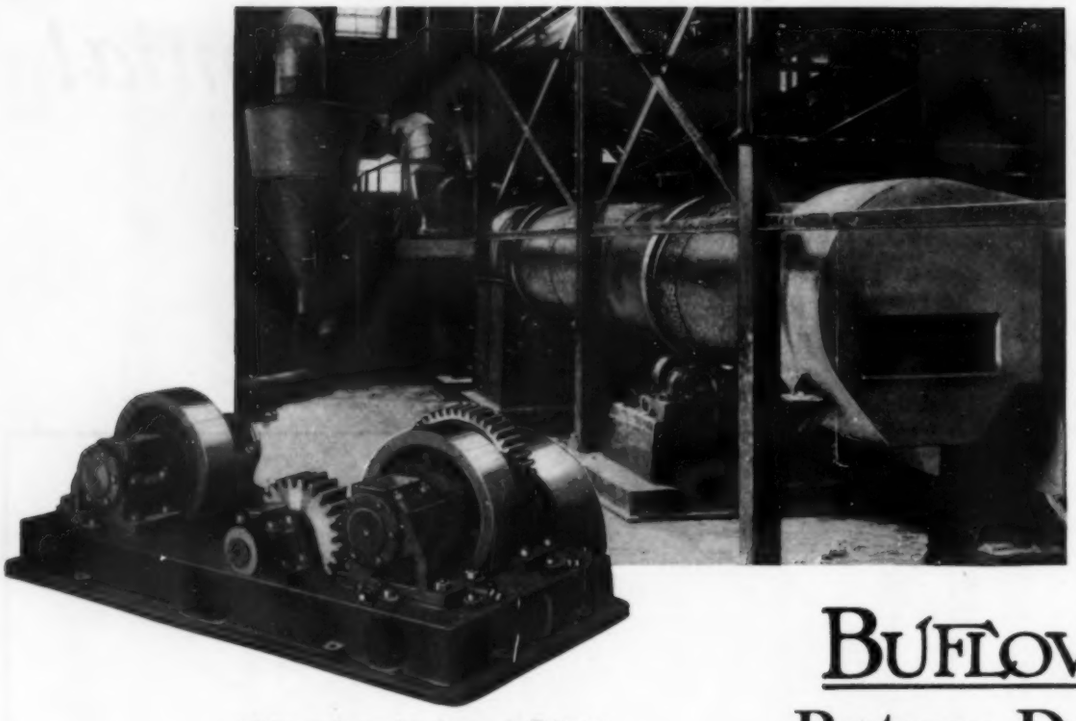
We design and erect complete plants in units from 2 to 20 tons per day capacity, and start same in operation.

Also Ammonia Oxidation Plants for Chambers
Ammonia Gas Generating Equipment
Ammonia Gas Accumulators
Ammonia Oxidizers and Preheaters
Nitric Oxide Gas Coolers
Nitric Acid Coolers
Nitrite of Soda, Sulfuric Acid and Muriatic Acid Plants

For further particulars apply to

Chemical Research & Designing Corporation

18 East 41st Street, New York



Drive and carrier base of BUFFLOVAK Hot Air Rotary Dryer. Either spur or bevel gears can be furnished.

BUFFLOVAK
Rotary Dryers
in the coke by-products Industry

THE drying of ammonium sulphate in the coke by-products industry, is one of the many successful applications of BUFFLOVAK Rotary Dryers to the drying problems of the process industries.

A performance analysis of this type dryer in treating some ninety different products shows several important operating economies.

The design of the dryer shell efficiently utilizes the heat units passing through it, effecting a saving right at the start. And this saving is further increased by the unusual constructional features particularly of the drive and thrust bases which assure longer life and a reduction in maintenance costs.

Bulletins 222 and 224

BUFFLOVAK Hot Air Rotary Dryers include such features as chilled rollers with ground faces; forged steel shafts supported in sturdy, dust and oil proof bearings; high carbon forged steel thrust rollers; SUMET Bronze thrust bearings; cut steel gears; flood lubrication for all bearings, etc. Completely described in Bulletins 222 and 224.

BUFFALO FOUNDRY & MACHINE CO.
1551 Fillmore Ave., Buffalo, N. Y.

NEW YORK — LONDON — CHICAGO
S. Bornett & Co., Ltd., 7 and 8 Idol Lane, Eastcheap, E.C. 3

DRYERS & EVAPORATORS FOR EVERY INDUSTRIAL USE

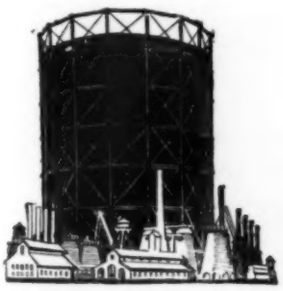
THE final score~ RESULTS

AFTER all it is *efficiency* that wins the day, and forges ahead. Arguments and discussion are all right in their place, but the deciding factor is RESULTS.

Shakespeare says, "A good wine needs no bush"—meaning, of course, that its superior qualities advertise themselves. This is true also of gas, as an industrial fuel.

Gas furnaces installed in all manner of industries are the most potent arguments for installing more gas furnaces in similar manufactories. Competitors must keep abreast of the times in methods of production or they will soon fall behind in the matter of profits.

If you do not know what gas furnaces are doing for other companies, in your line of business, find out at once. Write and ask your gas company. Details are available on practically every kind of industrial pursuit practised in this country.



Gas is the preferred fuel for over 60,000 users.

American Gas Association
420 Lexington Avenue, New York City

YOU CAN DO IT BETTER WITH GAS

In Step with the Publishing Needs of Industry

Twenty-five years ago, each industry was living pretty much unto itself. Industry traditions blocked progress. "Our business is different" sealed the eyes and ears of plant management in each line, forestalling adoption by one line of successful policies of the other lines about them.

The establishment of "Factory" and of "Industrial Management" symbolized a new era in management thinking—the consolidation of isolated industrial viewpoints into a broad outlook for industry as a whole.

These magazines pierced the walls of the century-old traditional thinking that had separated industries. Growing parallel in service, their pages demonstrated the common principles on which sound production management in any industry is based. They interpreted one industry to another. They served as a timely interchange of policy and method, experiment and fruition.

Today we see a veritable science of management arising from the free interchange of management thinking, accomplished through educational institutions, through national and local associations, through governmental and functional committees and through business papers.

But on publications lies the task of interpreting the common goals of management throughout industry. There is no other quick and universal method to coordinate and make common property the work of all other mediums of idea exchange.

The combination of "Factory" and "Industrial Management" also of "Industrial Engineering" and "Industry Illustrated" insures the expansion of a commanding service to plant management, with resources ample to the task.

A. W. Shaw

Chairman, A. W. Shaw Company
President, McGraw-Shaw Company

A-4

Reprinted from Advertising & Selling, Nov. 30; Class & Industrial Marketing, Dec.; Printers Ink, Dec. 8; and some December issue of Engineering News-Record, Electrical World, Power, American Machinist, Chemical & Metallurgical Engineering.

Tomorrow's manufacturing profits lurk in today's plant economies. Far-sighted production management is daily searching for clear principles, enlightened policies, penetrating methods. And industry's insistent demand for guidance makes stronger publishing service inevitable.

How can the activities of the manufacturing world be reported but by augmented reporting staffs!

How can significant tendencies be interpreted but by experts in management technique!

To the two publications of McGraw-Shaw Company, therefore, the McGraw-Hill Company pledges its whole resources of manpower and of industry contact. It joins with the A. W. Shaw Company in the backing of an expanded publishing program, in service to both reader and advertiser.

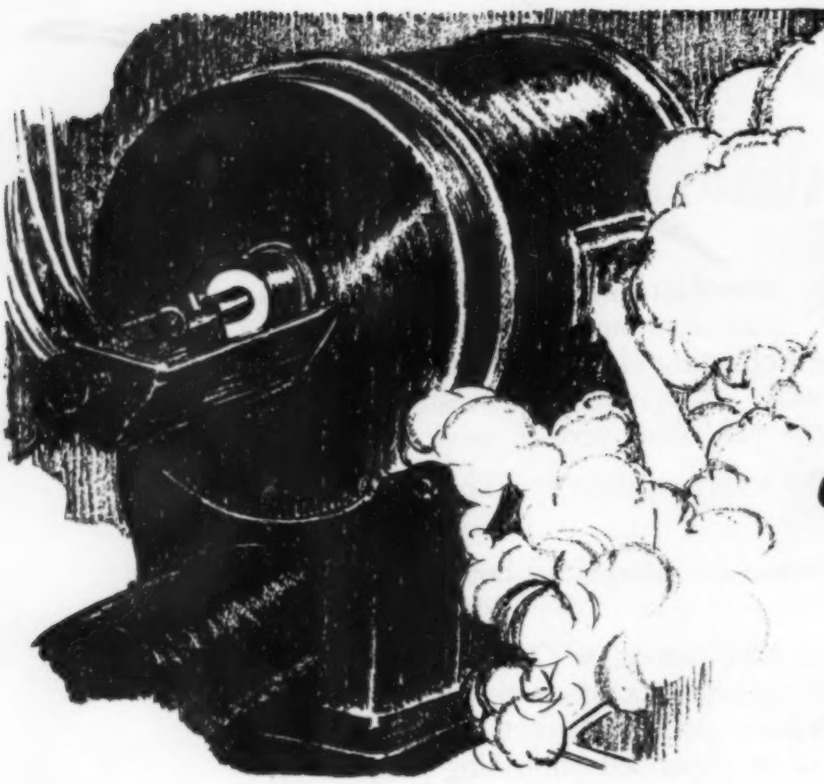
Editors will be given a free hand to interpret industry to itself. They will be expected to assume leadership, to point out production management's short-comings, to mould a program for production which thrusts its way through out-worn traditions and short-sighted inaction. Both "Factory and Industrial Management" and "Industrial Engineering with which is consolidated Industry Illustrated" will be guarantors of continued industrial foresightedness.

And for advertisers, the consolidation of four publications into two will make industrial marketing more effective. Supplementing the markets now offered by both McGraw-Hill and Shaw publications, the McGraw-Shaw publications will complete a waste-free service for the economical movement of industrial products.

James H. McGraw

President, McGraw-Hill Publishing Company, Inc.
Chairman, McGraw-Shaw Company

McGRAW-SHAW COMPANY
7 South Dearborn Street, Chicago
285 Madison Avenue, New York
A subsidiary of McGraw-Hill Publishing Company and A. W. Shaw Company
Publishers of "FACTORY AND INDUSTRIAL MANAGEMENT" *and*
"INDUSTRIAL ENGINEERING with which is consolidated INDUSTRY ILLUSTRATED"



Molten Metal! and its effect on refractories

PROBABLY one of the most severe uses to which refractories are subjected is the lining of metal-melting furnaces.

The Bohn Aluminum and Brass Corporation were having trouble with the linings of their seven one-ton electric furnaces. Turning out a ton of molten bronze at 2100° F *does* seem like a severe test!

However, Lawtonite linings were designed and installed. They are now standard equipment and here's why, quoting them:

"Experience has proved that it has three times the life of ordinary refractories and gives a lower cost per ton of melt with the added advantage of fewer interruptions to production."

Actual figures prove a saving *per furnace* per year of $291.20.

Lawtonite Refractories prove pretty definitely that first cost isn't the whole story.

Linings for—

Brass melting furnaces, alloy furnaces, heat treating furnaces, muffle furnaces, continuous kilns, annealing furnaces, enameling ovens, pottery kilns, gas producers, boiler settings, still settings, pit furnaces.

LAWTONITE
GRAPHITE AND CLAY
PRODUCTS
TRADE MARK
REG. U.S. PAT. OFF.

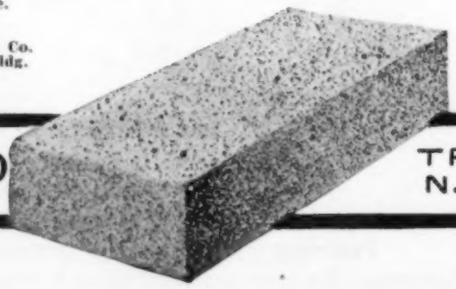
Francis Wagner
307 San Francisco St.,
El Paso, Tex.

E. D. Bullard Co.
565 Howard St.,
San Francisco, Cal.

A. C. Monlton
206 S. W. Temple,
Salt Lake City, Utah

D. M. Hamilton
3201 Lawrence Ave.
Detroit, Mich.

W. T. Withers Supply Co.
962 Atlanta Trust Bldg.
Atlanta, Ga.



JONATHAN BARTLEY CRUCIBLE CO TRENTON N. J.

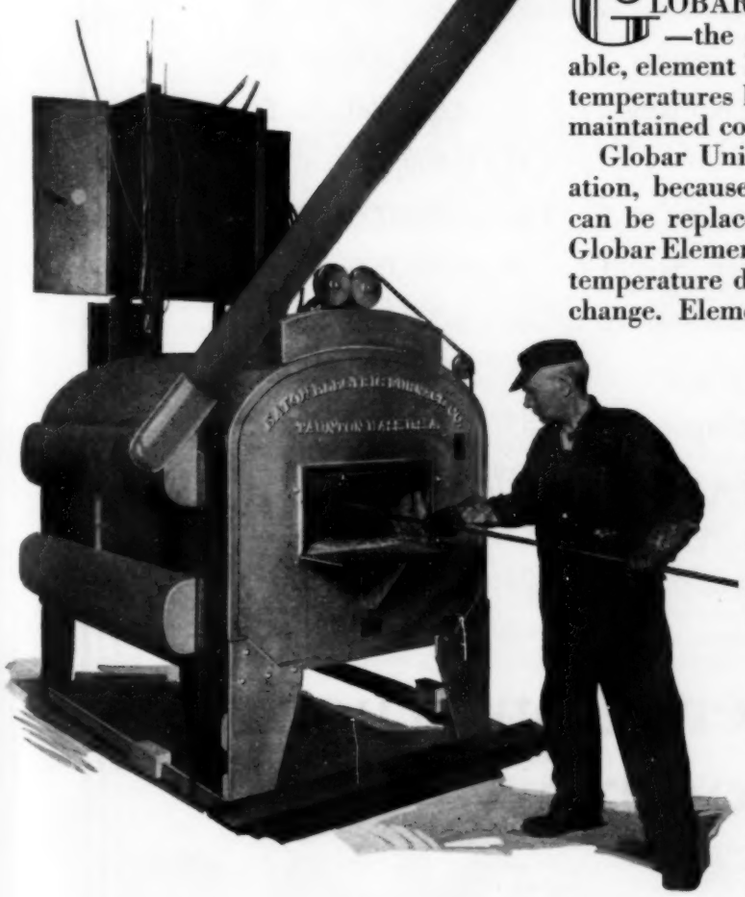
ELECTRIC HEATING *in Industry* HAS ARRIVED

and with it

Globar

REG. U.S. PAT. OFF.

The Non-Metallic CARTRIDGE TYPE *Heating Element*



GLOBAR is a resistance rod of Carborundum—the only cartridge type, quickly replaceable, element by which a uniform distribution of temperatures between 2000°F. and 2750°F. can be maintained commercially.

Globar Units insure continuity of furnace operation, because when necessary, a Globar Element can be replaced with the furnace maintained *hot*. Globar Elements have been replaced with a furnace temperature drop of only 200 degrees during the change. Element can be changed in five minutes.

WITH Globar Rods there is no need for reserve furnaces. Globar Elements are not affected by the ordinary commercial furnace temperatures. There is no decomposition below 2800°F. Sudden changes of temperature do not affect it.

Its coefficient of expansion is so low that there is practically no change in a six-foot unit, operating at 2500°F. It is sturdy, durable. It cannot short circuit—it cannot melt or fuse—it does not scale.

And Globar is the only electric heating element in which are combined both high and low resistances, thus making possible its "Cold End" feature.

Globar is the element of economy. It gives clean, uniform heat—it does not cause scaling—makes possible the production of a higher quality product.

With Globar Elements and electric heat your working conditions are improved—labor costs are reduced—production costs lowered—production volume increased.

Globar Elements are just as effective at low temperatures—in fact Globar can be made to meet any heating condition from 250° to 2750°F.

Globar is a Carborundum Product

REG. U. S. PAT. OFF.

GLOBAR CORPORATION. NIAGARA FALLS N. Y.

BECKER TYPE OVENS
in the
GAS INDUSTRY

Plants consisting of Becker Type Ovens and Koppers Gas Producers in operation by Gas Companies or under construction for them, have an aggregate annual gas capacity of approximately 28 billion cubic feet.

IN OPERATION

Plant and Location	No. Ovens	Max. Daily Sendout
Battle Creek Gas Company..... Battle Creek, Mich.	18	2,900,000 cu. ft.
Consumers Power Company.... Saginaw, Mich.	19	2,350,000 cu. ft.
Consumers Power Company.... Jackson, Mich.	15	1,500,000 cu. ft.
Winnipeg Electric Company.... Winnipeg, Canada	17	2,600,000 cu. ft.
Utica Gas & Electric Co..... Utica, N. Y.	42	6,600,000 cu. ft.
Lynn Gas & Electric Co..... Lynn, Mass.	11	1,750,000 cu. ft.
Northern Indiana Pub. Serv. Co. Fort Wayne, Ind.	19	3,000,000 cu. ft.
Rochester Gas & Electric Corp.. Rochester, N. Y.	60	8,000,000 cu. ft.
Consolidated Gas Company..... New York, N. Y.	74	20,000,000 cu. ft.
West Boston Gas Company..... Framingham, Mass.	15	1,500,000 cu. ft.

UNDER CONSTRUCTION

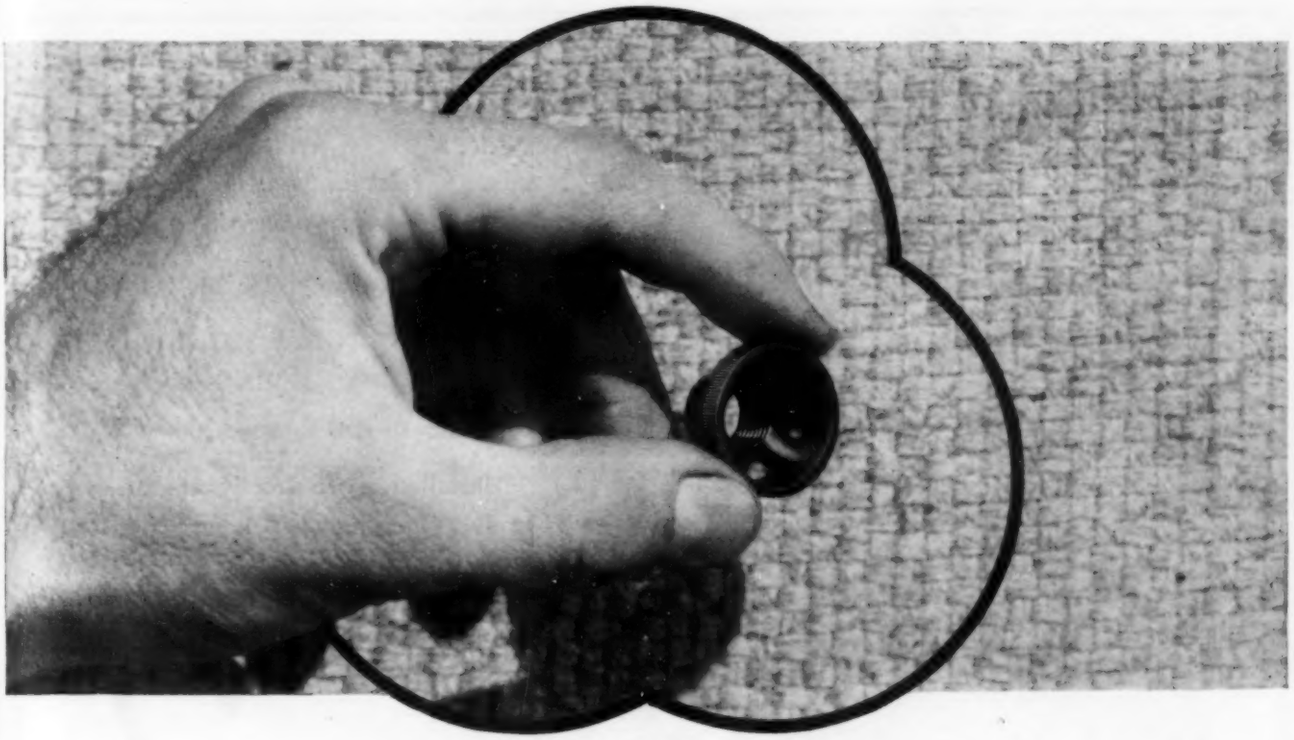
Consumers Power Company.... Flint, Mich.	29	4,000,000 cu. ft.
*Brooklyn Union Gas Co..... Brooklyn, N. Y.	74	20,000,000 cu. ft.

*Large Ovens.

The Koppers Construction Company

Designers and Builders of
BY-PRODUCT COKE AND GAS PLANTS

CHICAGO NEW YORK PITTSBURGH



Bakelite Molded Eye-Piece of Cystoscope
Made by American Cystoscope Co., Long Island City, N. Y.

This better Bakelite Molded Eye-Piece produced at a saving of 58%

ASTONISHING economies are sometimes effected through the use of Bakelite Molded. This Eye-Piece of the American Cystoscope is a typical example. With the materials formerly used, drilling, milling, threading and polishing operations were required. With Bakelite Molded none of these were required as the threads and knurled rim are formed, and a high lustre acquired in the molding operation.

Because of the uniform threading of the Bakelite Molded Eye-Pieces, no difficulty was experienced in passing the thread gauge, although this test was a source of trouble when other materials were used. And all of these advantages were gained at a saving in cost of over 58%.

Bakelite Engineering Service

It is our intimate knowledge of thousands of varied applications of Bakelite Materials, combined with our eighteen years' experience in the development of phenol resins for industrial uses that makes the cooperation offered by our engineers and research laboratories so valuable. In important cities throughout the country there are Bakelite Engineers ready to render prompt service in adapting Bakelite Materials to the needs of any manufacturers. Write for Booklet 7—"Bakelite Molded."

BAKELITE CORPORATION

247 Park Avenue, New York, N. Y. Chicago Office: 635 West 22nd Street

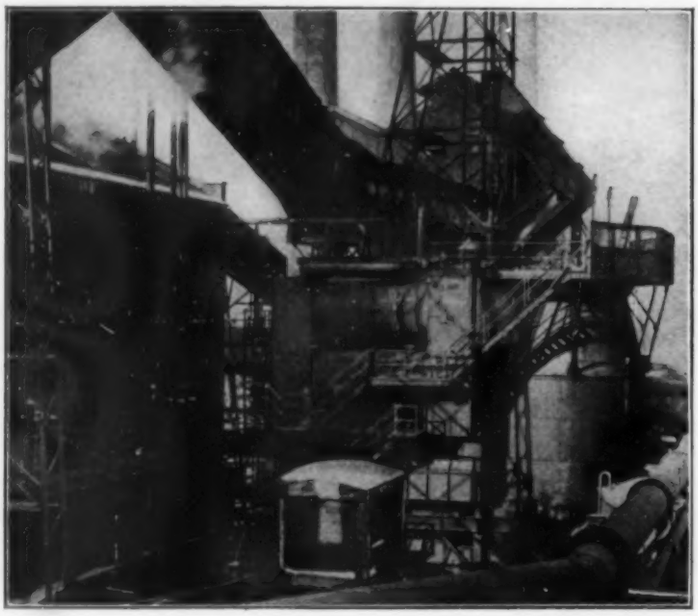
BAKELITE CORPORATION OF CANADA, LTD., 163 Dufferin St., Toronto, Ont.

BAKELITE

REGISTERED U. S. PAT. OFF.

THE MATERIAL OF A THOUSAND USES

"The registered Trade Mark and Symbol shown above may be used only on products made from materials manufactured by Bakelite Corporation Under the capital "B" is the numerical sign for infinity, or unlimited quantity It symbolizes the infinite number of present and future uses of Bakelite Corporation's products."



Installation of Sulzer System for Dry Quenching of Coke at Plant of the Rochester Gas & Electric Corporation, Rochester, N. Y.

Where is Dry Quenching Used?

AT By-Product Coke Plants, Gas Works, Low Temperature Carbonization Plants—in fact, wherever hot coke from retorts is now water-cooled—The Sulzer System for Dry Quenching may be profitably substituted.

Dry Quenching produces coke of more uniform quality, having greater mechanical strength, containing less breeze and dust—and, absolutely moisture free.

The sensible heat of the coke, which is entirely wasted in wet quenching, is reclaimed and produces from 650 to 900 pounds of steam per ton of coke dry quenched.

The Sulzer System is simple and flexible in design and is readily adapted to existing plants or to new installations.

In size, the field of application runs the entire gamut of coke plant practice. Sulzer Systems are available for daily capacities of from 10 tons to 1000 tons.

THE Sulzer System for Dry Quenching coke is simple and dependable. The hot coke is charged into a sealed quenching chamber. Inert gases are circulated in a closed cycle by means of a fan, first through the hot coke mass where they absorb the sensible heat of the glowing coke, and thence through a steam boiler where hot gases transfer this heat to the water in the boiler circulatory system and convert it into steam. Literature describing the Sulzer System will be sent upon request.

Dry Quenching Equipment Corporation

INTERNATIONAL COMBUSTION BUILDING

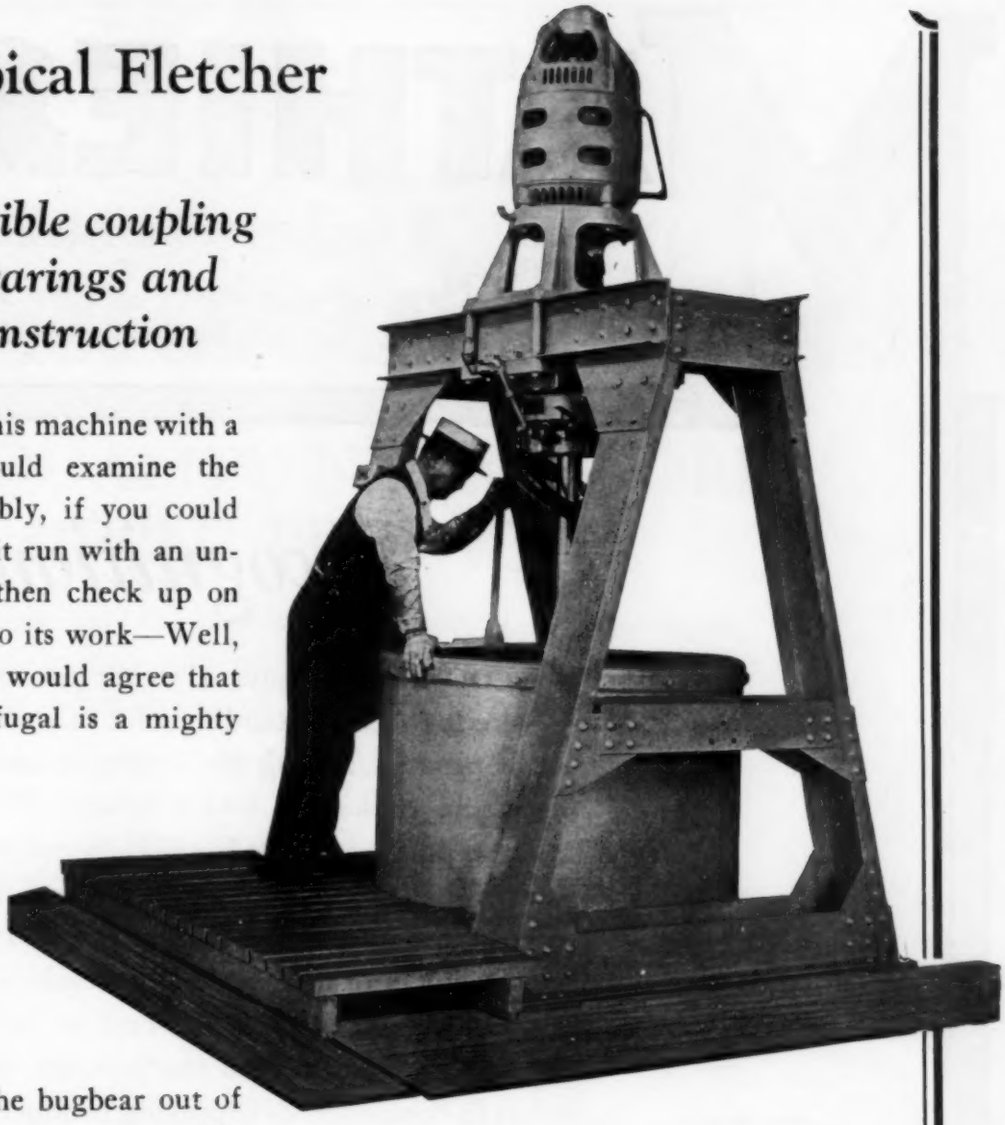
200 MADISON AVE. NEW YORK — N.Y.

A SUBSIDIARY OF INTERNATIONAL COMBUSTION ENGINEERING CORPORATION

Here's a typical Fletcher Installation

with motor-flexible coupling drive, ball bearings and balanced construction

If you could sound this machine with a hammer, if you could examine the materials and assembly, if you could stand by and watch it run with an unbalanced load, and then check up on the time it takes to do its work—Well, we feel that you too would agree that the Fletcher Centrifugal is a mighty fine investment.



Automatic Lubrication—Sight Feed!

This feature takes the bugbear out of operation. The operator can *see* the lubricant in its travel through the vitals of the machine. No chance of a dry bearing. Even at that, the ball bearing construction eliminates all danger of bearing failure.

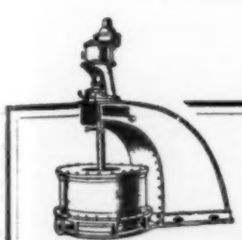
The Fletcher Centrifugal in all its forms, is a sturdy, efficient, profitable servant. Why not let it work for you?

A complete line

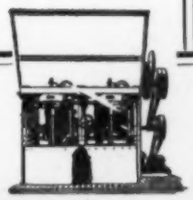
Suspended and underdriven centrifugals, with motor, belt or steam drive. Various sizes. Also accessories, mixers, feeding valves, unloaders, conveyors.

FLETCHER WORKS

INCORPORATED
Formerly SCHAUM & UHLINGER
Glenwood Avenue at Second Street, Philadelphia, U. S. A.
Established 1850
Western Representatives:
R. R. Street & Co., 28 N. Clinton Street, Chicago, Ill.
Pacific Coast Representatives:
Sharples Specialty Co., 686 Howard St., San Francisco, Cal.



FLETCHER



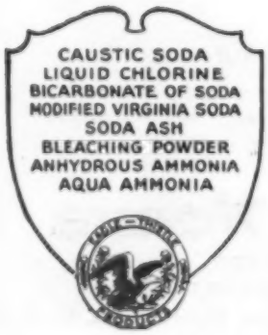
MATHIESON
Industrial Chemicals

Recognition

"RECOGNITION," says a writer on industrial marketing, "is the standing of a manufacturer, product by product, among the men who control the buying in the markets to which he sells."

To purchasers of industrial chemicals, Mathieson recognition is something that has been built up through years of constant, dependable service to the chemical consuming industries. It is the result of considering the interests of the consumer first, of maintaining uninterrupted contact with the product from raw materials to consumer, of supplying products of definitely known quality, of combining progressive Mathieson merchandising policies with the most up-to-date plant and warehouse facilities.

Regular renewal of contracts, year after year, and the constantly growing demand for EAGLE-THISTLE Chemicals backed by Mathieson service, furnish tangible evidence of this nation-wide recognition.



The MATHIESON ALKALI WORKS *Inc.*
250 PARK AVE. NEW YORK CITY

PHILADELPHIA CHICAGO PROVIDENCE CHARLOTTE CINCINNATI

Works: Niagara Falls, N. Y.—Saltville, Va.—Newark, N. Y.

Warehouse Stocks at all Distributing Centers

Producers of Commonwealth Vanillin, Coumarin, Benzoate of Soda, Benzoic Acid and Benzoyl Chloride

Deal Direct with the Manufacturer

HIGH QUALITY NAVAL STORES SHIPPED PROMPTLY

YOU can rely upon prompt shipment of fresh stocks of steam-distilled turpentine, steam-distilled pine oil and wood rosin, when you order from Hercules.

Our plants are producing continuously and in addition we keep reserve stocks on hand to fill orders promptly. We are, therefore, in a position to supply customers with fresh stocks at short notice.

Careful chemical control and modern plant facilities result in Naval Stores products, which are manufactured to specifications and are uniform in quality. Daily chemical and physical examinations and tests maintain a degree of purity and uniformity not otherwise possible.

HERCULES POWDER COMPANY
(INCORPORATED)

963 Market Street, Wilmington, Del.

HERCULES STEAM-DISTILLED
WOOD TURPENTINE, PINE OIL
AND HERCULES WOOD ROSIN

These panoramas show (above) the Hercules naval stores plant at Brunswick, Ga., and (below) the plant at Hattiesburg, Miss. Each plant is operated under chemical control and the highest standard of quality is rigidly maintained. The process used eliminates dirt, bark, sticks and other foreign matter and insures a clean and uniform rosin.

maximum chemical action

Lime is bought on the basis of results. Any lime may look good on paper—and there is no doubt of the importance of analysis in determining its efficiency. But peculiarly, chemical lime may vary in its value, according to the process in which it is used.

Chemists recognize this and seek therefore to fit the lime to the specific need. Marblehead has proven its fitness for perhaps the greatest variety of applications. It is because of inherently fine quality high calcium limestone, so mined as to preserve its purity, so calcined as to avoid contamination, so manufactured as to be practically unvarying in its composition.

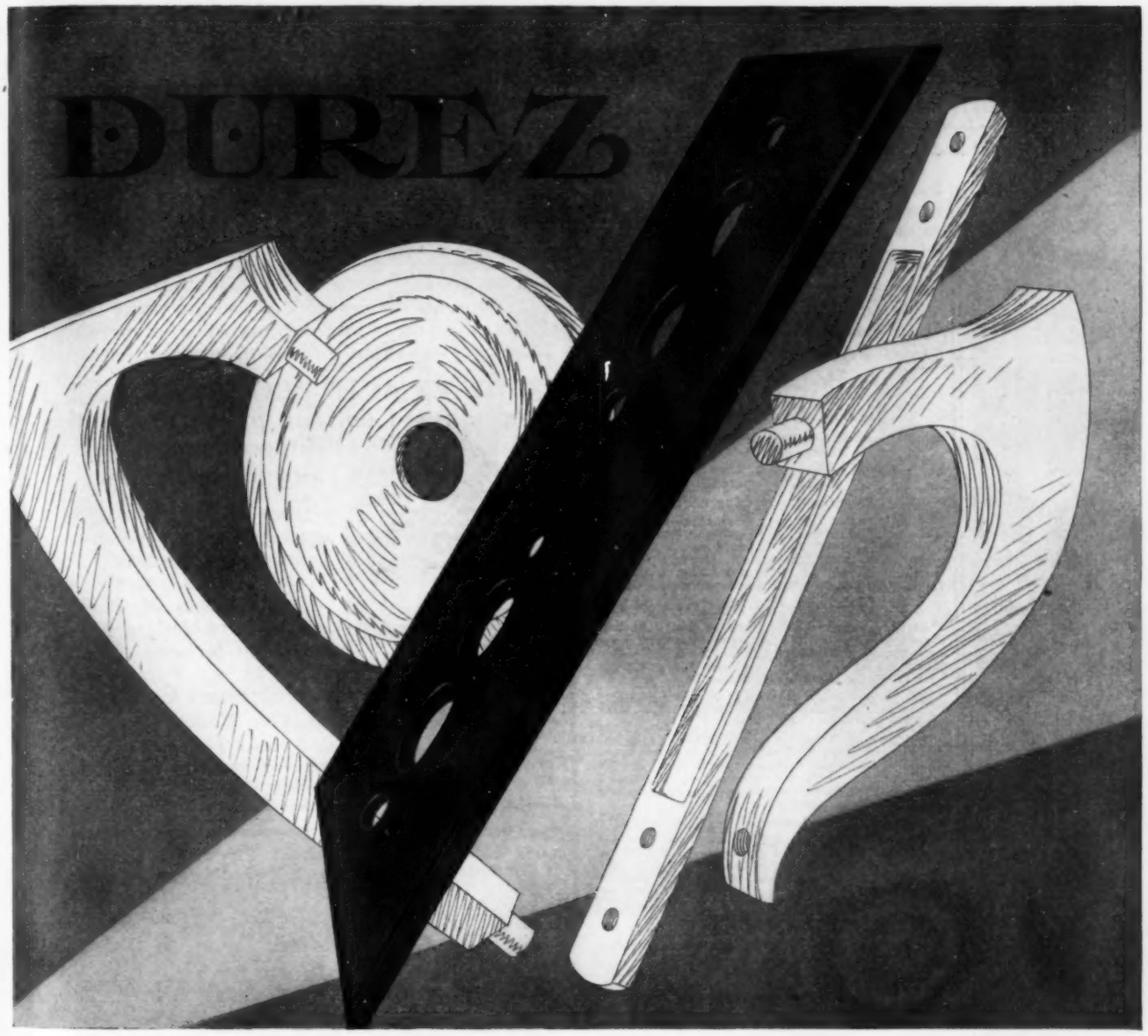
These qualities have given Marblehead preference in hundreds of plants using lime for all purposes, at distant points of the country as well as near by. They represent maximum chemical action—the activity that produces measurable results in your process.

It will pay you to investigate Marblehead. Analyses and samples on request—*booklets also gladly sent.*

MARBLEHEAD LIME COMPANY

Chicago, Ill. Hannibal, Mo. Kansas City, Mo.

MARBLEHEAD CHEMICAL LIME



Molded with DUREZ means *extra strength, unusual durability, exceptional accuracy*

MANY of the long list of applications of Durez to molded parts are the direct result of its mechanical stability — its physical strength. Durez replaces many materials—even metals—because it has stamina and endurance unusual in a plastic. Use it for parts with thin sections, when lightness and strength are essential.

Molded Durez is lustrous and hard, without being brittle. It is molded in hot presses under a tremendous pressure that makes its structure dense and tough. Durez resists wear indefinitely and will not check, scar or crack.

Durez has mold-ability that reproduces the most complex and close-dimensioned parts with great accuracy. The exact duplication of Durez molded parts facilitates assembly. Durez further reduces manufacturing costs by making machining and finishing unnecessary. Several parts made of some other material often can be consolidated into a single piece when Durez is used to mold it.

This is an era of plastic molding. Increase your production, improve your product with Durez. Consult the Durez laboratory about the use of molded parts in your plant. The services of experienced chemists and engineers are at your disposal without obligation.

Molded samples of Durez and complete information on its properties supplied on request. Specify use and color.

GENERAL PLASTICS
INCORPORATED
NORTH TONAWANDA, NEW YORK
CHICAGO NEW YORK SAN FRANCISCO

DUREZ

SEND FOR THE BOOKLET, "DO IT WITH DUREZ"

FREE
HOLIDAY
STAMPING OFFER

Until January 1st, 1928, we will stamp your name, or a friend's name, in gold on the front cover of this book. Orders for stamped copies should be accompanied by price and, of course, stamped books are not returnable. Offer expires January 1st, 1928.

Published September, 1927
Second Edition—Revised and Enlarged

Principles of Chemical Engineering

By William H. Walker, Warren K. Lewis and William H. McAdams

771 pages, 6x9, illustrated
$5.50 net, postpaid

Chemical Engineering Series

A concise but thorough presentation of those principles of science upon which chemical engineering operations are based and a development of methods for applying these principles to the solution of such problems as present themselves in chemical engineering practice.

New Features of this Revision

In the chapter on the Flow of Heat, the constants and the form of several equations have been modified slightly to make them more generally applicable and conform more closely with recently determined data.

The quantitative treatment of gas producers has been amplified by including illustrative problems.

In the discussion of rectification, graphical methods of computation have been substituted for the algebraic technique employed in the first edition, because the former are more rapid and the significance of the steps much more readily visualized.

An appendix of problems has been added.

Two new chapters have been added on the underlying principles of diffusion—applications include absorption of hydrocarbons both by oil and by charcoal, decolorization of liquids by percolation filters, countercurrent leaching of solids, and the like.

CHAPTER HEADINGS

I. Elements of Industrial Stoichiometry.
II. Fluid Films.
III. Flow of Fluids.
IV. Flow of Heat.
V. Fuels and Power.
VI. Combustion.
VII. Furnaces and Kilns.
VIII. Gas Producers.
IX. Crushing and Grinding.
X. Mechanical Separation.
XI. Filtration.
XII. Basic Principles of Vaporization Processes.
XIII. Evaporation.
XIV. Humidity and Wet and Dry Bulb Thermometry.
XV. Humidifiers, Dehumidifiers and Water Coolers.
XVI. Drying.
XVII. Distillation.
XVIII. General Principles of Diffusional Processes.
XIX. Absorption and Extraction.

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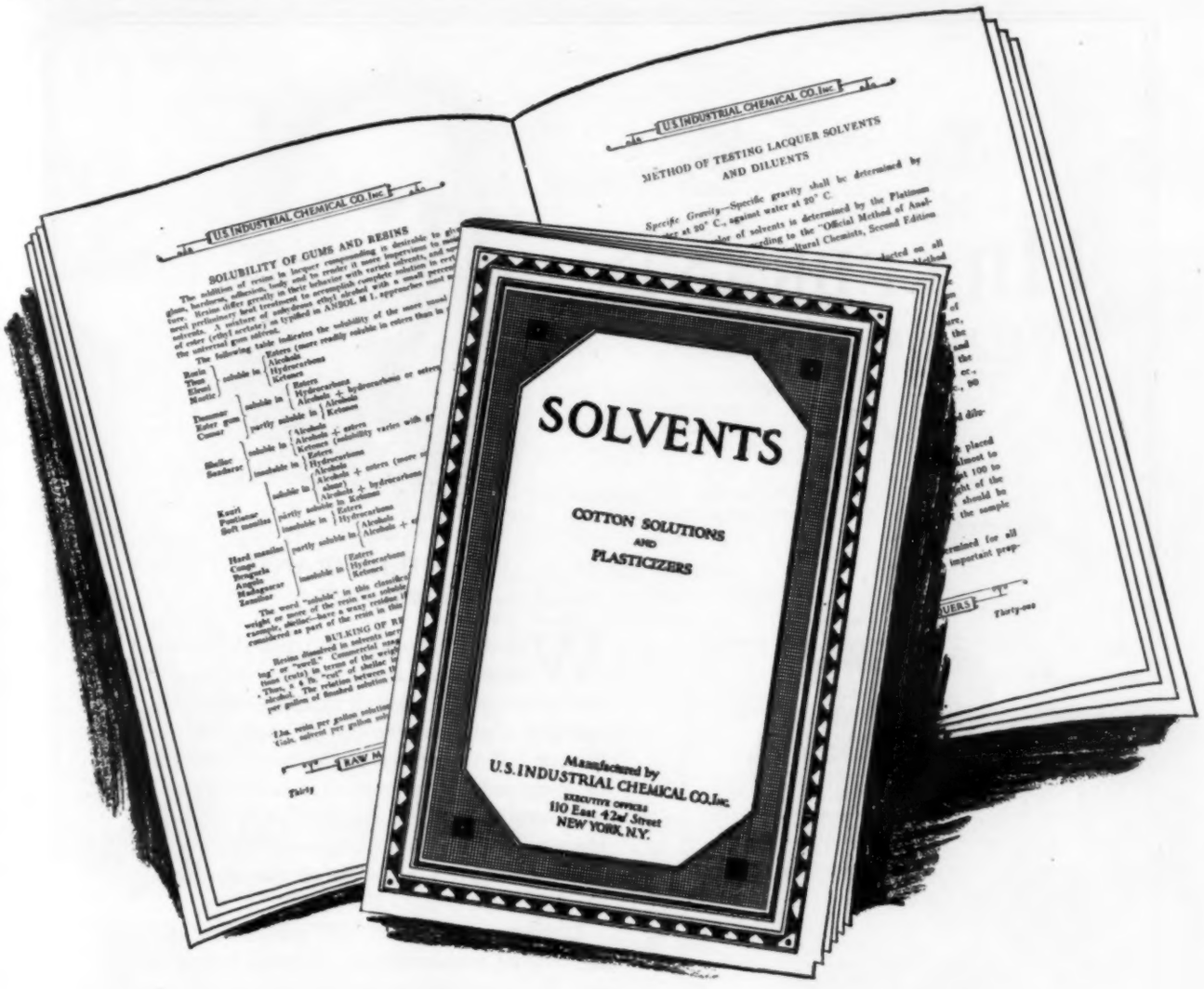

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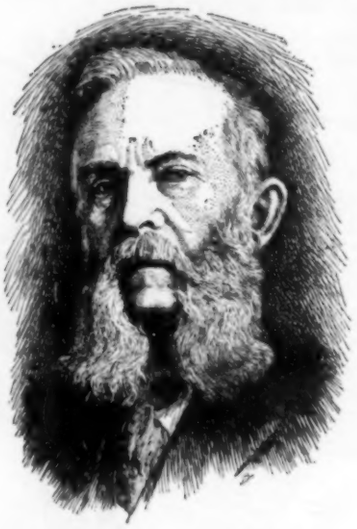

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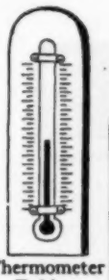
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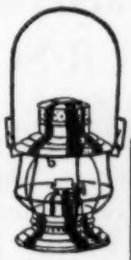
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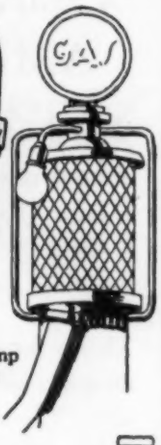
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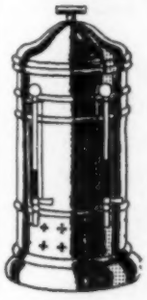
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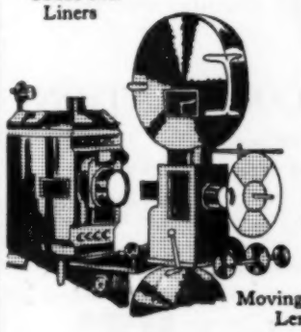
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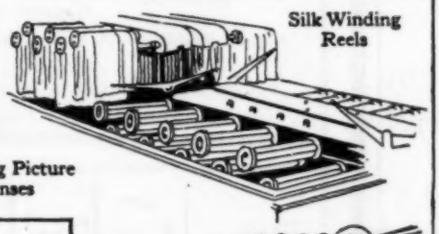
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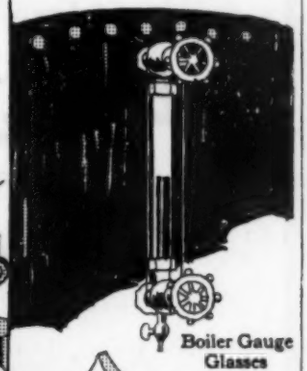
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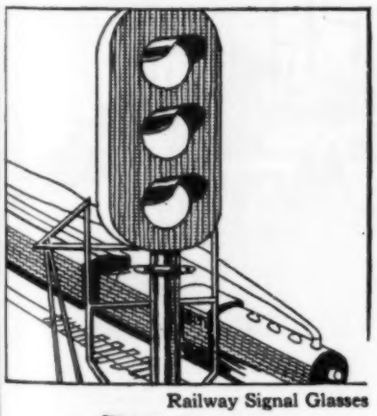
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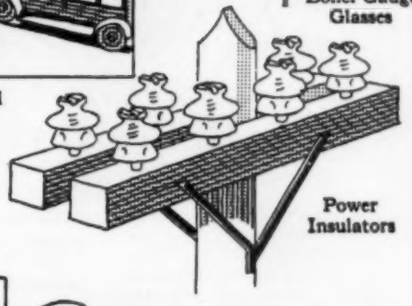
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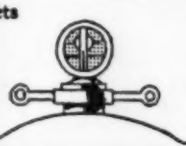
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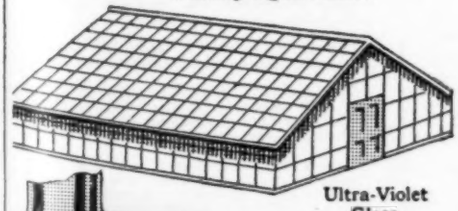
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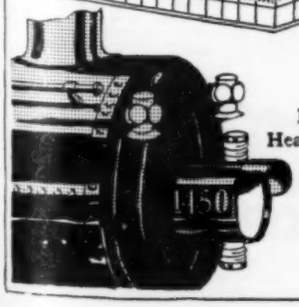
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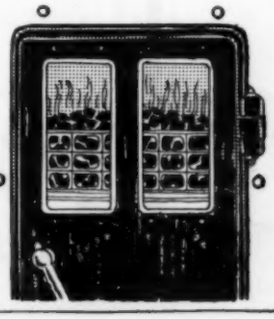

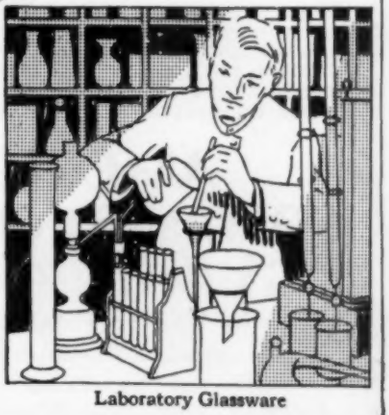
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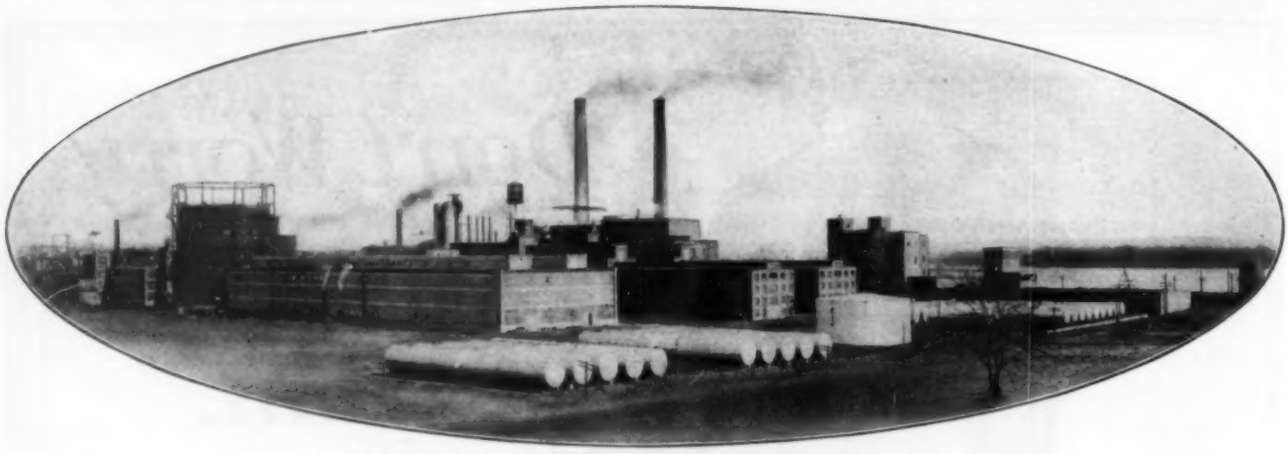

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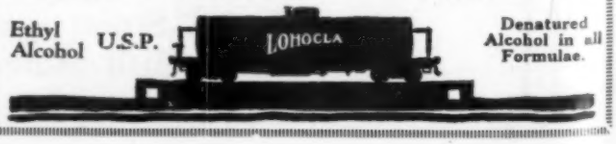

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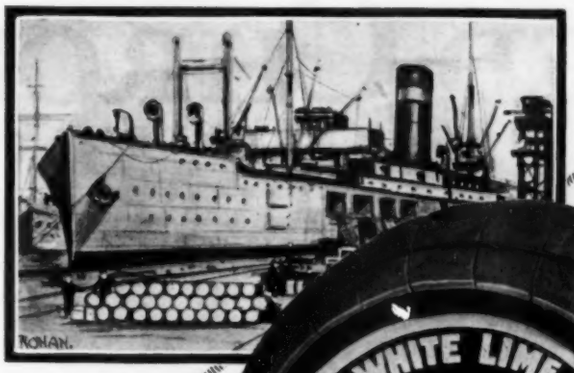

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The value of Carpenter Stainless Steels lies not alone in their corrosion and heat-resisting properties—they are, in every sense of the word, *true steels*. By proper selection, they can be furnished to duplicate the physical properties of the regular carbon and alloy steels with which you are quite familiar. You have at your command in Carpenter Stainless Steels a tensile range from 70,000 lbs. to 260,000 lbs. per square inch. The hardness can be varied from dead-soft, deep-drawing quality, to a full spring temper.

Stainless Steel is made in the Carpenter mills in three distinct types, and each having its own physical characteristics. The range of tensile properties for each grade is approximately as follows:

	CARPENTER STAINLESS STEEL NO. 1	CARPENTER STAINLESS STEEL NO. 2	CARPENTER STAINLESS STEEL NO. 3
	Lbs. per sq. in.	Lbs. per sq. in.	Lbs. per sq. in.
Tensile Strength	70,000 to 190,000	85,000 to 260,000	80,000 to 110,000
Yield Point	50,000 to 165,000	58,000 to 225,000	55,000 to 75,000
Elongation in 2"	35% to 11%	27% to 11%	27% to 18%
Reduction of Area	78% to 50%	65% to 32%	70% to 46%
Shore Hardness	24 to 55	30 to 75	28 to 35
Brinell Hardness	143 to 387	187 to 512	174 to 223

Although Carpenter Stainless Steel No. 2 can be heat treated to embrace a very wide range of physical properties, it is recommended for use only when treated to a tensile strength in excess of 200,000 lbs. per sq. in. When treated below this figure, the No. 2 analysis is not as corrosion-resisting as the No. 1 grade and it is more expensive to fabricate. There is, therefore, no advantage in using it for any purpose where the physical requirements can be met with the No. 1 grade. The field for Stainless No. 2 lies exclusively in hardened parts; this is because it owes much of its stainless properties to the hardening treatment.

Carpenter Stainless No. 3 does not respond to heat treatment and is always used in the condition as furnished by the mill. The grade depends in no way upon heat treatment for its corrosion-resisting and heat-resisting properties—it is always at its best. Carpenter Stainless No. 3, in the annealed condition, has physical properties from 50% to 100% higher than cold rolled steel, and can be profitably substituted for ordinary untreated steel or practically any of the non-ferrous metals.

Carpenter Stainless No. 1 is one of the most remarkable and versatile stainless metals ever developed. It can be used anywhere throughout its wide range of physical properties and is at once tough, ductile and strong. Although its corrosion-resisting properties are slightly better in the fully hardened condition, it has remarkable stability throughout its entire range of properties.

Annealed dead-soft, Carpenter Stainless Steel No. 1 is ideal for moderately deep drawing or severe forming. In its intermediate tempers, it is widely used for turbine blades, pump shafts, valve spindles, and trim, and other highly stressed parts which are heat treated before finish machining. In its fully hardened condition, Carpenter Stainless Steel No. 1 rivals the medium-carbon, chrome-nickel steels for heavy duty stud bolts, live axles, generator shafts and such parts which must combine wear resistance, great strength and a dependable toughness.

All three grades are readily machinable in the annealed condition and can be forged, bent, formed, cold drawn, blanked, punched, welded, soldered or brazed.

It is the function of CARPENTER STAINLESS STEEL SERVICE to consult and cooperate with engineers having corrosion problems to combat, and we shall be very glad to have any such problems submitted to us for consideration.

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READING, PENNSYLVANIA

Photo shows plant of an outstanding public utility company where Corrugated Sheet Zinc is used for roofing and siding of various buildings and conveyor galleries.

When Zinc is used for roofing and siding —*Exit "Depreciation"!*

No need to write off large yearly totals for plant depreciation on buildings with roofing and siding of Corrugated Sheet Zinc—for this non-rusting material lasts indefinitely. The first cost is the last expense. Early zinc roofs laid in this country have served 75 years; in France and Belgium there are Zinc roofs more than 100 years old.

The advantages of using Corrugated Sheet Zinc—zinc through and through—on industrial buildings are becoming widely recognized by engineers, as evidenced by the increasing number of installations of this permanent metal.

Corrugated Sheet Zinc can be applied over steel framing, where the sheets are fastened to purlins and girts by the familiar methods used for other sheet metal construction, or may be used over a full-boarded surface.

Before you build ask The New Jersey Zinc Company for facts and quotations on Corrugated Sheet Zinc. Figured over a period of years it is the lowest cost metal roofing and siding you can buy.

Process Industries in which the typical buildings may be constructed of Corrugated Sheet Zinc.

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The New Jersey Zinc Company
(Established 1848)
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160 Front Street, New York City
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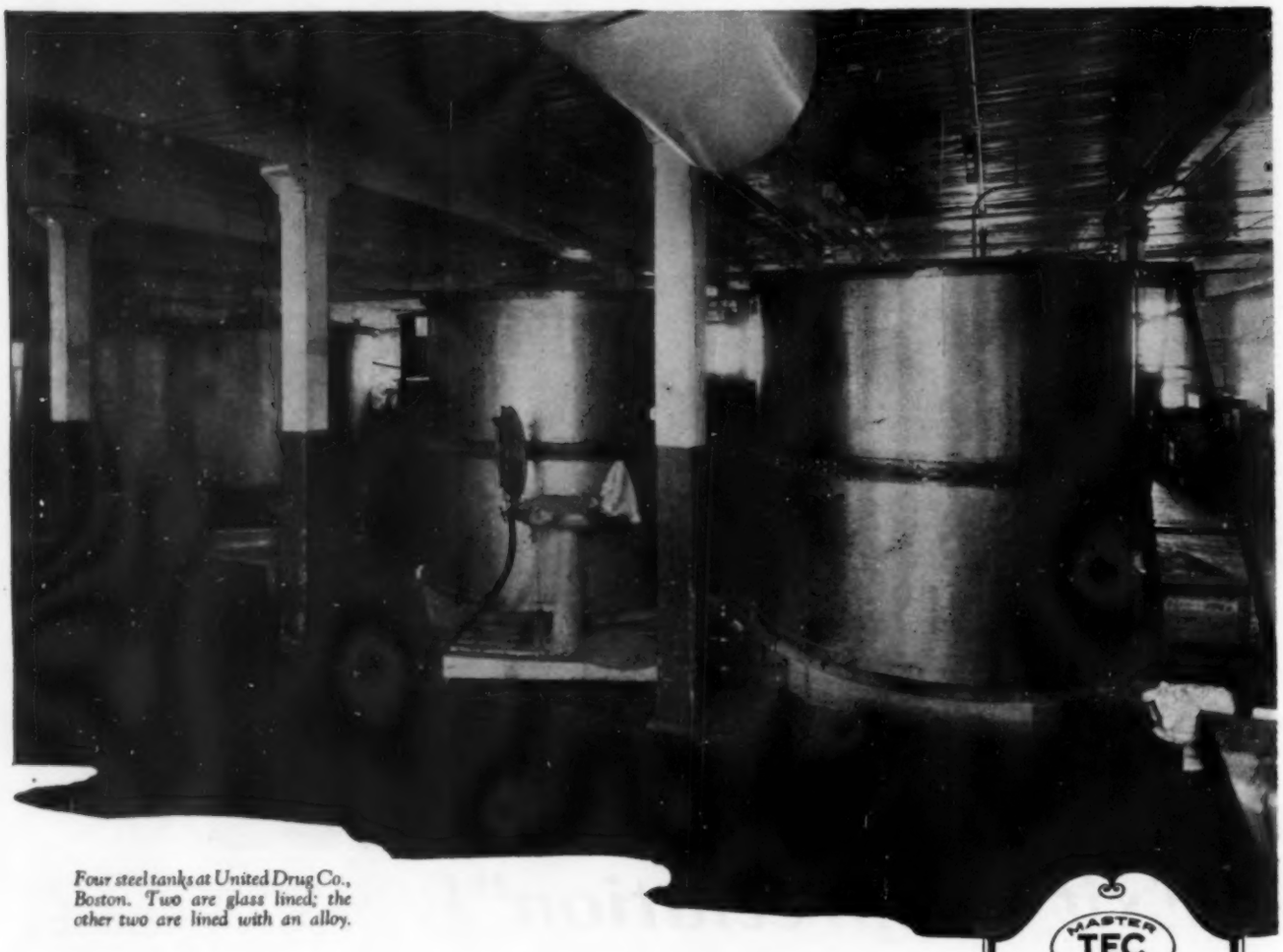
CORRUGATED SHEET Zinc
zinc through and through

Every superintendent, manager and owner interested in permanent building protection should write for the free specification book "Zinc Roofing and Siding for Industrial Buildings."

The New Jersey Zinc Co., 160 Front St., New York
Send me information on the use of Corrugated Sheet Zinc for roofing and siding for:
Type of Building.....
Firm.....
Mr.....
Address.....
C&M-12



Four steel tanks at United Drug Co., Boston. Two are glass lined; the other two are lined with an alloy.

The Most Useful Low-Cost Material in Industry

Materials of which process equipment is built are sometimes predetermined by the nature of the product to be handled. More often than not Sheet Steel is the natural selection. It is the most useful low-cost structural material in industry.

For tanks, bins, spiral chutes, etc., Sheet Steel presents fabricating and service advantages which make for low first-cost and low cost per year of service.

Sheet Steel is easy to bend to any required shape. It is easy to fabricate. It gives strength with light weight, and durability—at economical cost. It, therefore, solves many of the problems arising through the need of special equipment.

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For particulars write the SHEET STEEL TRADE EXTENSION COMMITTEE, OLIVER BUILDING, PITTSBURGH, PENNSYLVANIA.

MASTER TEC BRAND

This trade-mark stenciled on galvanized Sheet Steel is definite insurance to the buyer that every sheet so branded is of prime quality—full weight for the gauge stamped on the sheet—never less than 28 gauge—and that the galvanizing is of the full weight and quality established by the SHEET STEEL TRADE EXTENSION COMMITTEE *specification.*

SHEET STEEL

for Strength Safety Beauty *and* Economy

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CHROMIUM Plating, having proved an exceptionally effective resistant to wear, heat and corrosion, has awakened industrial executives and platers everywhere to its possibilities for many industrial uses and as a beautiful and permanent finish for innumerable manufactured products.

In view of this interest it is quite natural that many have experimented with Chromium plating, unaware that although the laboratory process of depositing Chromium electrolytically is a simple one, the successful commercial application of this process is the result of many years of research and experience.

The "Crodon" process of Chromium plating has been developed by the pioneers in the field, through years of experimentation and at a cost of thousands of dollars. Its adoption has enabled manufacturers and platers everywhere to quickly, economically and successfully employ chromium plating to meet their own peculiar requirements, saving them the inevitable and unnecessary costly expenditure of time and money that follows individual experimentation.

1. Harder than case-hardened steel!
2. Resists heat!
3. Immune from atmospheric corrosion!
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The corrosion resisting alloy with the strength of steel

Members of the Aluminum Bronze Manufacturers' Institute have determined standards of physical properties which make certain satisfactory results from the use of this alloy in recommended application.

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AN IRON THAT *RESISTS* RUST-ACID-CORROSION

So much so, in fact, that it is used for nitric acid containers, turbine buckets, blades, coal mine equipment, marine hardware, and sporting goods.

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is worthy of your investigation.

May we send you the facts?

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STEELS SPECIAL PURPOSES — WATERVLIET-N.Y.-U.S.A.

The unseen fire* that takes its toll from industry

This fire is rust . . . more treacherous than flames. Wise business men guard against it by using *Armco* Ingot Iron.

RUST is a fire that gives no warning. Day in and day out it attacks the costly tools of industry all unseen.

Not until busy equipment is destroyed . . . production held up . . . and repair crews are finished with their work, can loss from rust fire be computed. And all too often it is written off in depreciation figures that might have been profits.

That is why more and more of America's biggest industries are protecting their huge equipment investments by specifying *Armco* Ingot Iron for all sheet metal work.

No other metal gives such long time, low-cost service on the roof and in the walls of factory buildings . . . in tanks, stacks, and boilers. And where equipment is exposed to unusually severe conditions, as in mines, railroad cars and coal-handling machinery, the use of *Armco* Ingot Iron has proved a special economy.

For this iron is practically free from the impurities that hasten rust in steel and other irons. The Armco Triangle stamped on every sheet of metal is your best ally in fighting rust. It identifies the purest iron made.

Armco Ingot Iron is saving thousands of dollars by putting off repairs for years. And when they *are* necessary the job goes faster because this iron is unusually ductile and easy to work. Isn't it poor economy to build with less enduring metal when sixty cents of every dollar on a sheet metal job is spent for labor?

If you are contemplating an installation requiring extra large plates, you will be glad to know that *Armco* Ingot Iron is now obtainable in practically any sizes and thicknesses, and for any purpose. The same qualities are predominant—purity, uniformity, weldability, and rust-resistance.

Write or wire your needs.

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INGOT IRON
RESISTS RUST

THE AMERICAN ROLLING MILL COMPANY
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Export:
The Armco International Corp.
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RUST-FIRE! The only difference between rusting and burning is time—both are oxidation. You can feel and see the fire produced by rapid burning. But when metal rusts, the process is too slow to see. Rust is the "ash" of this fire.

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Center Jet Nozzles

Sectional View Showing Action of Center Jet

Satisfied users . . . thousands of them . . . with any number of diversified needs . . . have given them severe tests, and found them efficient. Can we say more? Try them for

Atomizing Liquids	Cooling Water
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Pure Manganese	96-98% Mn.
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Our customers who have become acquainted with our welded chrome iron (stainless) tubing, will be glad to learn that we are now handling seamless as well.

We are making prompt delivery against orders.

Heat Resistant

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Stainless TUBES

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Enduro Stainless Iron

The Metal that Resists Rust, Scaling and Corrosion

PRODUCED with the same painstaking care that has long characterized our output of Agathon Alloy Steels—we now offer you a *stainless iron* having countless possibilities.

Agathon Enduro Stainless Iron takes a permanent finish brighter than nickel. It is not easily scratched, withstands deep drawing operations, and can be readily spun, forged or machined. Stronger than medium carbon steel, it requires no heat treatment to develop its stainless properties.

Thousands of uses await this remarkable iron. Some are shown in illustration above. If your product embodies polished parts exposed to the ravages of the elements, or injurious effects of acids, solutions and compounds—write us.

Agathon Enduro Stainless can be—Spun, Forged, Welded, Riveted, Machined, Cold Worked.

Agathon Enduro Stainless resists—Abrasion, Nitric Acid, Alkali Solutions, Moist or Sea Air, Superheated Steam, Fruit and Vegetable Acids, Scaling at High Temperatures, Sulphides and Sulphur Compounds.

Central Alloy Steel Corporation, Massillon, Ohio

Makers of Agathon Alloy Steels

Cleveland	Detroit	Chicago	New York	St. Louis
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AGATHON ENDURO STAINLESS

AGATHON ENDURO STAINLESS IRON

The underlines are ours—

Silent Inefficiency

FACTORS that contribute to inefficiency in a plant may be divided into two classes, those that call attention to their presence by some disagreeable action and those that are silent. Steam blowing out of a leaky gland, a leak in a water or oil line are likely to receive attention on account of the displeasing condition they create, while other leaks that are not visible may be entirely ignored.

Unfortunately, by far the most important causes of inefficiency are silent. [illegible] and other hot su[illegible]

Editorial from Oct. 11th, 1927 issue of "Power"

Mason Regulators put an effective stop to one of the worst forms of "silent inefficiency."

They are designed, built and tested to meet the most exacting conditions of service and their accuracy does not diminish with long continued use.

Write for a copy of Catalog No. 62 giving a complete description and prices of Mason Regulators for every power and process service.

Mason Regulators

MASON REGULATOR CO.
Boston, Mass.

San Francisco Office, 606 Howard Street
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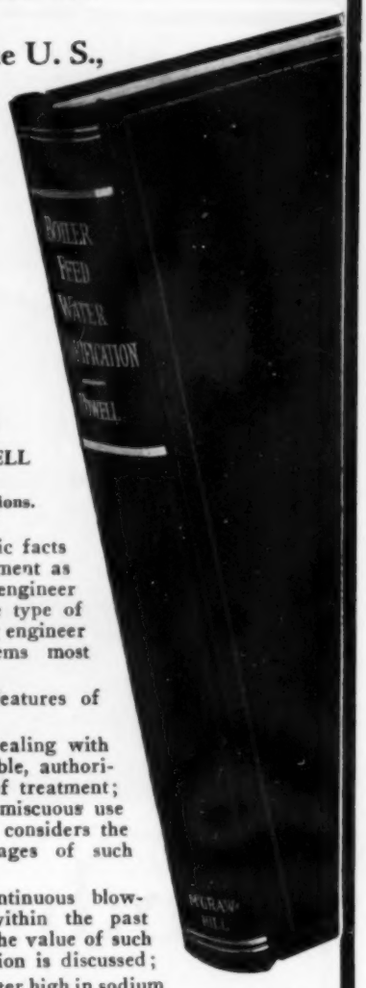
1445

Every aspect of boiler feed water treatment as practised both in the U. S., and abroad—

A book on boiler feed water purification that possesses many unusual features; a vigorous discussion, easy to read, understand, and apply.

Published October, 1927



Boiler Feed Water Purification

By SHEPPARD T. POWELL
Consulting Engineer

363 pages, 6x9, 158 illustrations. Price, $4.00 net, postpaid.

The book presents such basic facts concerning feed-water treatment as may assist the designing engineer in selecting the appropriate type of treatment, and the operating engineer in controlling boiler systems most efficiently.

Some of the outstanding features of this new book are:

—the portion of the book dealing with boiler compounds is a reliable, authoritative review of this form of treatment; it shows the danger of promiscuous use of unknown compounds and considers the advantages and disadvantages of such compounds;

—the various types of continuous blow-down systems developed within the past year or two are described; the value of such appliances and their utilization is discussed;

—the addition of acids to water high in sodium salts to prevent boiler steel embrittlement is discussed in detail;

—the book gives a comprehensive survey of priming and foaming of boiler waters and methods of control;

—the discussion also includes methods of water analysis prepared for those who have had no training in chemistry.

Read this list of chapter headings

I.—Natural Waters and Their Impurities;
II.—Removal of Suspended Solids by Plain Subsidence;
III.—Chemical Coagulation;
IV.—Filtration;
V.—Water Softening by Chemicals;
VI.—Water Softening by Zeolites;
VII.—Evaporators, Their Design and Operation;
VIII.—Deaeration of Feed Water;
IX.—Deconcentrators and Continuous Blow-down Systems;
X.—Boiler Compounds;
XI.—Priming and Foaming;
XII.—Corrosion—Its Cause and Cure;
XIII.—Embrittlement of Boiler Metal;
XIV.—Feed Water Heaters and Miscellaneous Treatment;
XV.—Standard Methods of Water Analysis.

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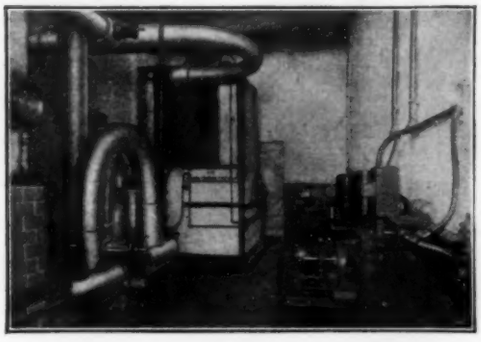

Absorber Room—Showing One of Two 1,200,000 B.t.u. Heaters

The Saturant, made up of various pitches, paraffin, gilsonite, etc., is first prepared in large Melting Kettles by raising to a temperature of 400°F or thereabouts and agitating slowly for a uniform mixture. The temperature to which the Saturant is raised must be high enough for complete melting and blending, without overheating. Overheating would destroy some of the valuable ingredients by charring and evaporating.

Through a system of Jacketed Pipes the Saturant is transferred to the Dipping or Saturating Tanks, where the first Protective Operation takes place. As the wire passes through the tank the Cotton Braiding is thoroughly saturated to preserve the Cotton and keep light or other destructive agents away from either the Rubber Covering or the Copper Wire. The Copper, Rubber, and Cotton all take up heat during this operation, large quantities of it, and it must be supplied in an even flow to hold the Saturant temperature within close limits. Too low a temperature would not give proper saturation, and too high would mean insufficient material for protection.

The Wire next passes into the Coating or Polishing Tanks where a heavy coating is applied. This coating, high in wax content, completely covers the outside and protects against moisture.

To meet the rigid specifications of Insulation and Flexibility demanded by the Electrical Code, the manufacturer should equip himself with machinery built for performance. A method of heating that will do this with all the exactness demanded, is worth much to the manufacturer.

A Merrill Process Circulating Oil System will give the higher temperatures necessary in the Melting Kettles; also the smooth flow of heat for uniform temperature in the Saturating and Coating Tanks, without pressure. A Product of Quality with maximum output is insured.

Write for Booklet No. 725

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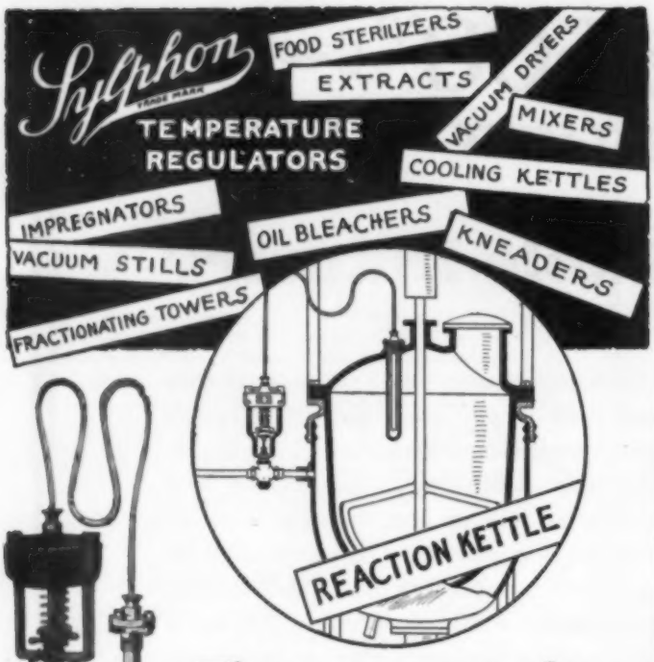

There are many places where you can profit with dependable Temperature Control

The reaction kettle, whether used for sulphonation, nitration, hydrogenation, reduction, digestion, cooking, or for any other chemical process, is one of many points in the chemical field where temperature is the key-factor in making a uniform product.

A Sylphon Temperature Regulator, set to control the temperature on your kettle at the exact degree you know to be best for your product, will assure accurate, dependable and completely automatic temperature control without attention or repairs. You profit by higher yield, dependable production, uniform quality, and the elimination of spoilage losses and by-reactions.

The many temperature problems in the chemical and allied industries cannot be covered in one bulletin; we have, however, described in detail many of the common, profitable applications of automatic temperature control in our Bulletin ET-108. If your chemical process is heated by steam or cooled with brine, this bulletin will help you to greater profits. Ask for a copy.

With the Sylphon BELLOWS —They have to be dependable.

The patented, self-contained motor element of all Sylphon Regulators.

Recognized by engineers throughout the world as the most durable, sensitive expansion unit in existence.

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And now

Condenser Tube Packing that meets every requirement

1. Quickly and easily applied.
2. Will not harden in service.
3. Does not adhere to tube or tube plate.
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5. Has ability to compress without excessive pressure.
6. Seats itself in stuffing box and on tubes forming a perfect seal.
7. Allows tubes to elongate and contract.
8. Will resist high temperatures and acids.

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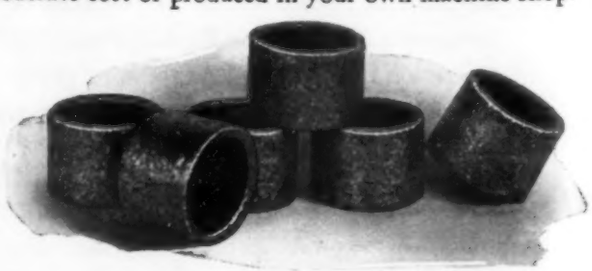
In offering Garlock Condenser Tube Packing to the trade we are placing on the market an entirely new type, yet not untested article. We have been furnishing the packing to a few of our customers and on account of the extreme satisfactory service obtained have decided to make it a part of our regular line of Quality Controlled Products. Garlock Condenser Tube Packing is formed in rings to any specified dimensions from unvulcanized asbestos fibrous compound of high tensile strength. A special surface treatment applied to the rings enables them to fulfill several of the features listed above.

The illustrations picture the application of Garlock Condenser Tube Packing. The special tool can be purchased at moderate cost or produced in your own machine shop.



Write for circulars describing the packing. Samples will also be furnished on request.

THE GARLOCK PACKING COMPANY

PALMYRA, N. Y.

Manufacturers of "Quality Controlled" Mechanical Packing

DISSERTATIONS on DISSIMILARITIES

Great as it is, the dissimilarity between salt and soap is irrelevant in their manufacture. The same fundamental process step—

EVAPORATION

is employed in the production of both!

Coal Tar Products, Coal By-products, Electrochemical Products, Explosives, Cellulose, Fertilizers, Fine Chemicals, Food Products, Glue and Gelatin, Heavy Chemicals, Paint and Varnish, Petroleum Refining, Pulp and Paper, Soap, Sugar and Wood Chemicals are the more important process industries that employ the evaporation process.

In the application of this process the question of proper temperature is of major importance. To meet its specific needs, there is a *Tycos* Indicating, Recording or Controlling instrument designed and calibrated for each of the evaporation process applications.

These instruments, as a result of many years use in the process industries, are recognized by them as the most important aid in assuring uniformly high grade products.

Tycos engineers will gladly consult with you on any manufacturing or laboratory temperature control need. They are qualified to make recommendations which will quickly and effectively fulfill your requirements.

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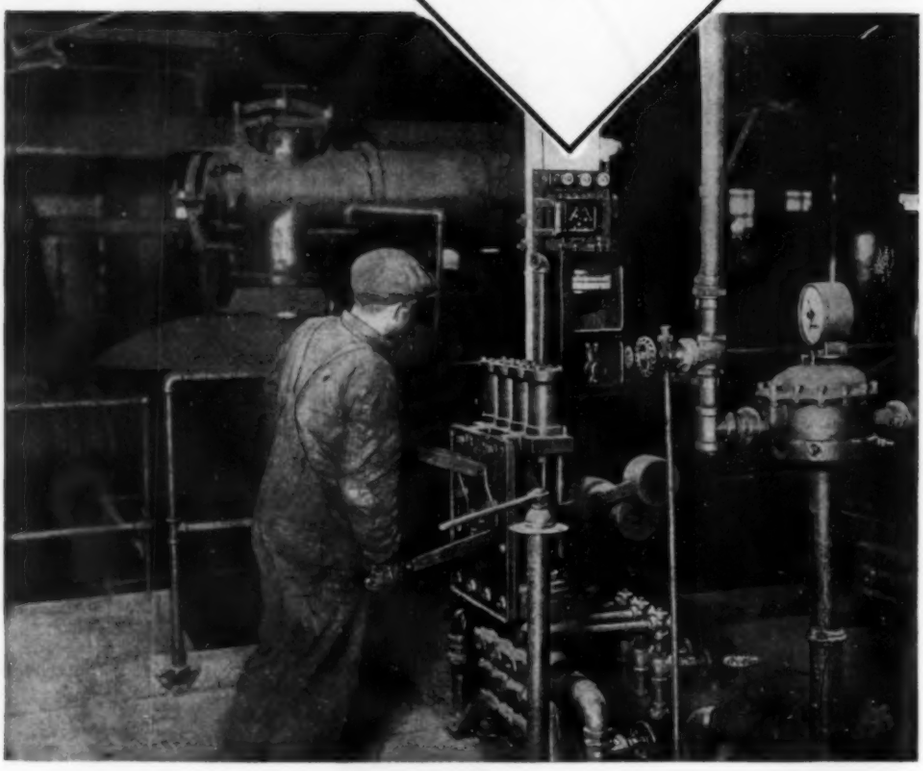
Tycos
the
SIXTH SENSE
of Industry

Tycos INDICATING RECORDING CONTROLLING
Temperature Instruments

Red . White . Green

You stop and go with the traffic signal. This is what the workman in the picture is doing in accordance with the signals flashed by the Brown Signaling Pyrometer constantly before him.



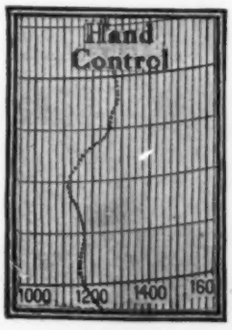
Signal Lights... *every*

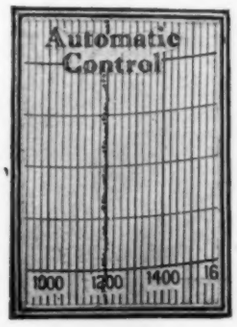
Through the eye. . . through the ear. . . Brown Automatic Control by light, or alarm, speaks to workmen—warns of high pressure—excessive temperature—slow speed—in hundreds of vital processes of modern industry. Workmen understand signals. They act. As a result, standards are more closely maintained. Less waste. Less spoilage. Less labor. More output. A better product.

"To Measure is to Economize"—Pascal

Brown Automatic

WHICH DO YOU WANT





THIS OR THIS?

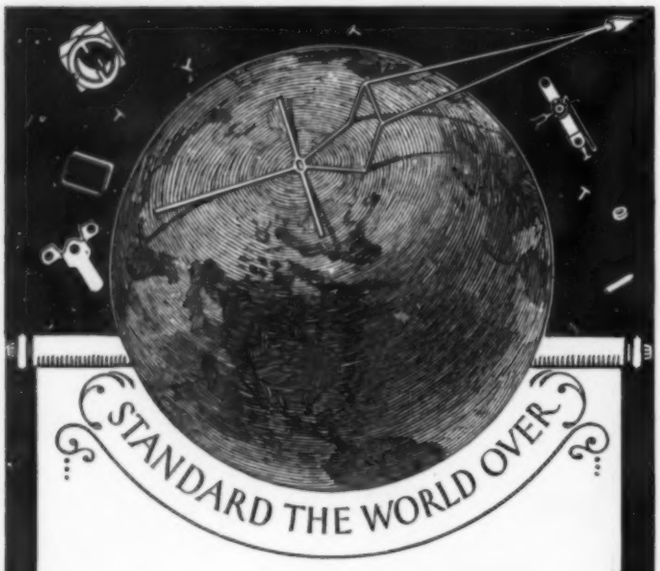
This record of furnace temperature was taken under hand control, before automatic control was installed.

This record was taken after automatic control was installed. The difference between manual operation and automatic control is obvious.

speak a language workman understands

Brown Automatic Control installations are producing these results in the process industries all over the country. Apply this equipment to *your* service. Write for the Brown Automatic Control Catalog—No. 87. The Brown Instrument Co., 4407 Wayne Ave., Philadelphia, Pa. *Offices in 18 principal cities.*

Temperature Control



Again WESTON points the way with these new A.C. panel models.

THIS LITTLE POINTER symbolizes the thousands of precise parts used in the construction of the complete line of Weston instruments—the most trustworthy guides to electrical equipment control known to science.

Also all forms of mechanical and electrical power now *visualize their efficiency* for you, in whatever units you desire, through the agency of "Westons."

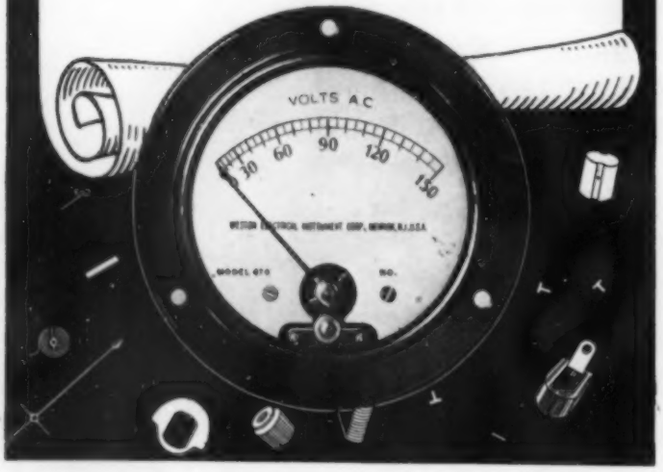
Of wide scientific and industrial application are the small panel A.C. Voltmeters, Ammeters and Milliammeters—Model 476, 3¼in. diameter; and Model 517, 2 in. diameter,—shown in the illustration.

They are made with exceptionally high internal resistance, giving low power consumption, and are excellently damped. The same high quality of materials and workmanship as in larger models and the same accurate Weston service on any commercial frequency.

Their unusual characteristics, matched appearance with the D.C. and Thermo-couple models, and space economy will appeal to you when in the market for small A. C. panel instruments.

WESTON ELECTRICAL INSTRUMENT CORPORATION

137 Weston Ave. Newark, N. J.



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"The Right Gate in the Right Place"

Threaded Connections

. . . is the way one manufacturer puts it—and not only voices his own experience but that of countless other users of Rockwell Air-Tight Blast Gates.

These gates differ from other gates in that they are air-tight—sufficient reason in itself to recommend your installing them. But there are other distinguishing characteristics too, including slides that "stay put" and provision to utilize the full area of the pipe line.

Rockwell Air-Tight Blast Gates are ideal control units for low pressure air, gases, liquids, granular material, distillates, etc.

Made with threaded or flanged connections, in a variety of types and sizes.

Write for Bulletin 282-E and further information.

New York
Detroit
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Canadian Distributor: Drummond, McCall & Co., Ltd., Montreal

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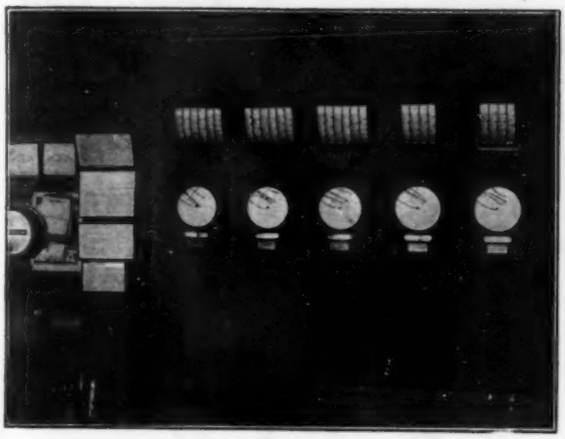
BAILEY METERS

are serving *the leaders* in the PAPER INDUSTRY



LOOK over the partial list of prominent paper companies using Bailey Meters. They find Bailey Meters of material assistance in reducing the cost of a ton of paper.

It is the same way with other industries. All the Process Industries are using them to reduce the cost of their products as effected by the cost of power and process steam.

Bailey Boiler Meters give every detail of boiler operation. Bailey Fluid Meters, installed on steam or water lines to various departments, give continuous and accurate accounting of distribution. Faulty or inefficient operation of machines can be immediately detected. The Bailey Gas Meter records and integrates the flow of gases. The Gravity Recorder gives the true specific gravity of liquids, guaranteed accurate within 1% of the chart range.

For further details, check the Bulletins you want and send in the coupon.

BAILEY METER COMPANY
1054 Ivanhoe Road, Cleveland, Ohio

Mail the Coupon NOW!

Prominent Paper Companies Using Bailey Meters

Abitibi Power & Paper Co.	25
Champion Coated Paper Co.	26
Eddy Paper Corporation	14
Great Northern Paper Co.	55
International Paper Co.	40
Kimberly Clark Company	46
Lake Superior Paper Co.	21
Laurentide Company	25
Minnesota & Ontario Paper Co.	41
Nekoosa Edwards Paper Co.	17
Oxford Paper Company	34
Spanish River Pulp and Paper Co.	34
St. Maurice Paper Co., Ltd.	20

Algonquin Paper Company
American Writing Paper Company
Brompton Pulp and Paper Co., Ltd.
Cherry River Paper Company
Dill and Collins
Donnacona Paper Company
Escanaba Paper Company
Gardner Harvey Paper Company
Gilman Paper Company
P. H. Glatfelter Company
Hinde & Dauch Paper Company
Jessup & Moore Paper Company
National Paper Products Company
Northwest Paper Company
Riordon Pulp & Paper Company
Standard Paper Company
St. Lawrence Paper Mills
Thilmany Pulp & Paper Company
United Paperboard Company
Watab Paper Company
West Va. Pulp & Paper Company

☐ GRAVITY RECORDER
☐ FLUID METER
☐ GAS OR AIR METER
☐ BOILER METER
☐ MULTI-POINTER GAGE
☐ COAL METER

Bailey Meter Co.
Cleveland, Ohio

Please send me the Bulletins checked.

Name.....

Firm.....

Address.....

I Guess So . . . . ?

"You *guess* so?"—blurted the Treasurer. "Don't you *know* whether our standard temperatures were maintained?

"Those goods are a total loss because you've used too much heat. We could have bought a hundred temperature controllers for the cost of those ruined goods."

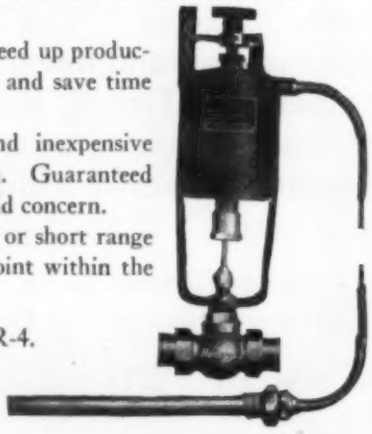
Why wait until you suffer a big loss before taking steps to guarantee uniform temperature control? Install American Temperature Controllers now and be absolutely assured that any desired temperature will be *automatically* maintained without attention of employes.

These instruments speed up production, eliminate spoilage and save time of employes.

They are simple and inexpensive to install and maintain. Guaranteed accurate by a 76-year-old concern.

Furnished with long or short range for operation at any point within the range.

Write for Catalog R-4.



AMERICAN SCHAEFFER & BUDENBERG CORP.
338 Berry St., Brooklyn, N. Y.

Atlanta	Cleveland	Minneapolis	*San Francisco
*Boston	Detroit	Philadelphia	*Seattle
Buffalo	Houston	*Pittsburgh	St Louis
*Chicago	*Los Angeles	Salt Lake City	*Tulsa

*Stock carried at these branches.

Direct Factory Representatives for Eastern Canada Mechanical Equipment Co., 415 New Birks Building, Montreal. For Middle Western Canada: Kipp-Kelly, Ltd., 68 Higgins Ave. Winnipeg.

AMERICAN TEMPERATURE CONTROLLER

"We find your instrument to be very accurate and sensitive at all temperatures besides being most convenient to handle during the heat readings and furthermore easily moved about to various places."

Used in over 6,000 plants the world over. Pyrometer Instrument Co., 74 Reade St., New York.

Pyro
Radiation Pyrometer

2243

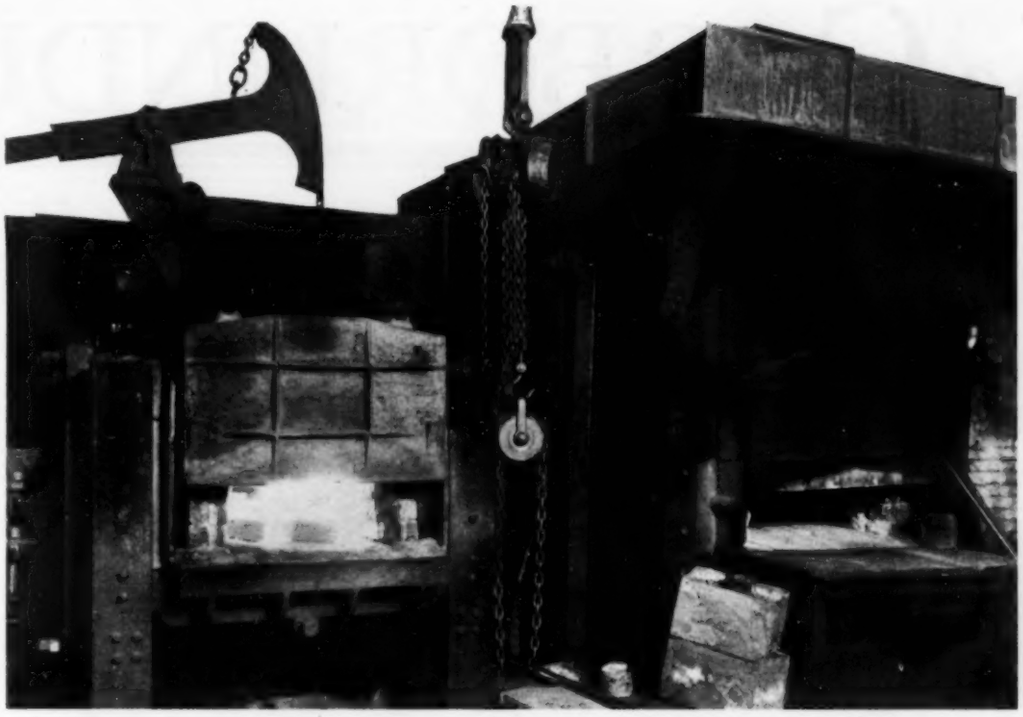
Expert Lead Burning
Chemical Plant Equipment

Lead tanks, lead linings coils, pipe and fittings, for vacuum equipment,

Contractors in lead burning and the construction of chemical equipment in lead, aluminum, copper, tin, nickel, monel metal, brass, iron, New construction and plant maintenance work.

Also manufacturers of Blower Systems for Industrial Plants Ventilating, Drying, Dust Recovery and Collecting Paint Spray Exhaust, Pneumatic Conveying Special Shop and Machine Work.

NIAGARA BLOWER COMPANY
673 Ontario Street, BUFFALO, N. Y.
ELECTRIC AND GAS WELDING OF ALL KINDS



FOUR YEARS *of* CONTINUOUS SERVICE

The oil-fired forge furnace at the left was built and lined with Crystolon Bricks just four years ago. It has seen continuous use—and hard use—yet the original bricks are still in service.

When the heat-treating furnace at the right was constructed a fire clay lining was installed. In fifteen months it was necessary to reline it and this time Crystolon Plates were used. They have already been in service over two years yet are in excellent condition, showing no signs of deterioration.

The long life which Crystolon Bricks and Plates are showing in these two furnaces in the plant of a large New England foundry and machine shop is not unusual. It indicates the service that may be expected from these Norton products.

NORTON COMPANY, WORCESTER, MASSACHUSETTS

New York Chicago Cleveland

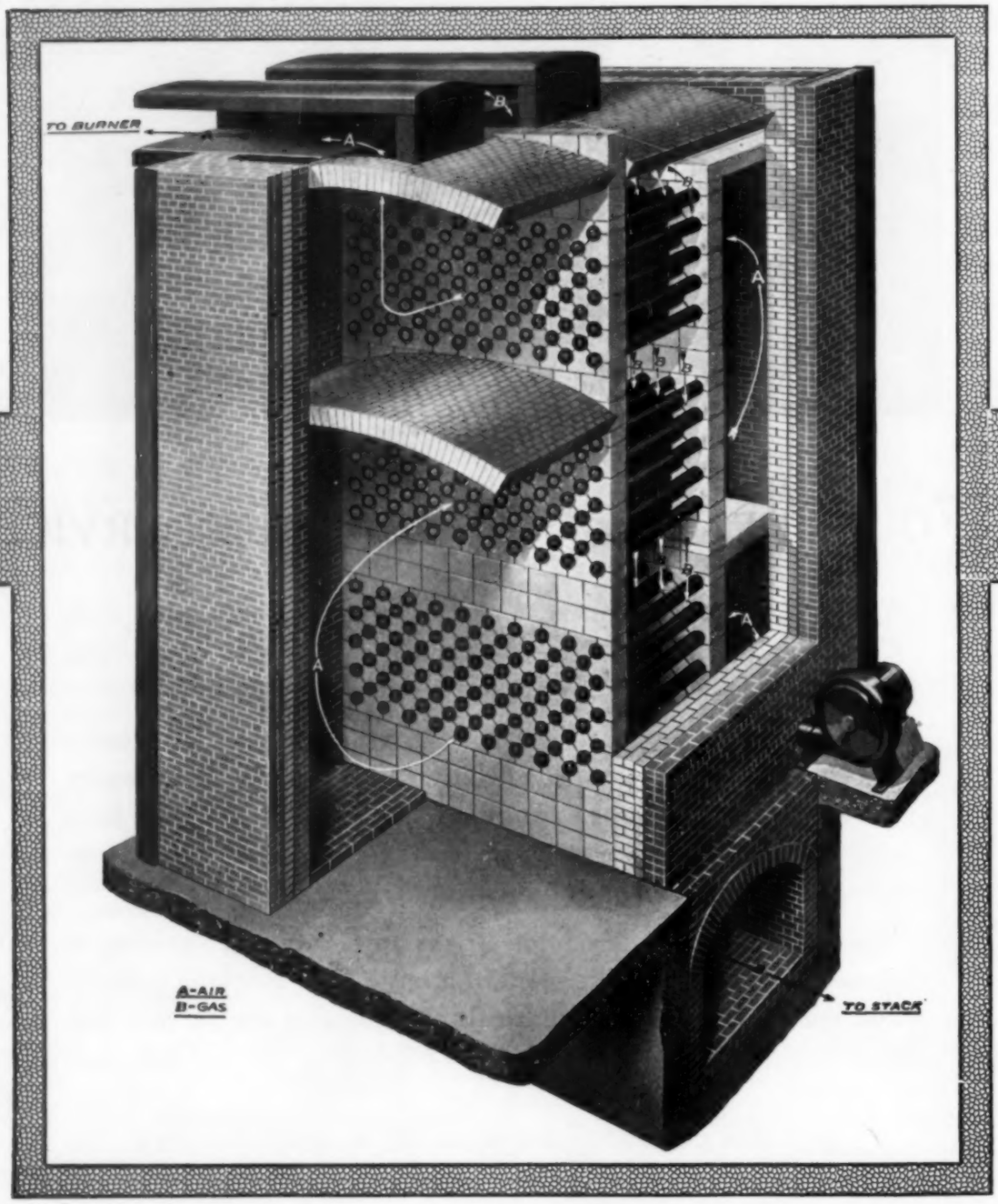
R-313

NORTON
REFRACTORIES

The CARBORUNDUM

REG. U. S. PAT. OFF.

LICENSED UNDER



THE CARBORUNDUM COMPANY

CARBORUNDUM IS THE REGISTERED TRADE NAME USED BY THE CARBORUNDUM COMPANY FOR

RECUPERATOR

FITCH PATENTS

CARBORUNDUM Recuperators have been in service continuously for the past two years under the following conditions—

Application:

Operating in conjunction with a continuous furnace.

Fuel:

Natural gas.

270,000 cu. ft. of gas burned every twenty-four hours.

Average temperature of furnace gases entering recuperator 1480°F.

Average temperature of air to burners 700°F.

Average heat transfer 5 B.T.U. per sq. ft. of exposed surface of tube per degree F. per hour.

Results:

38% fuel saving over previous practice.

Leak-proof design.

Cost of building lowest per unit of work done.

After two years, physical condition of recuperator as good as when new.

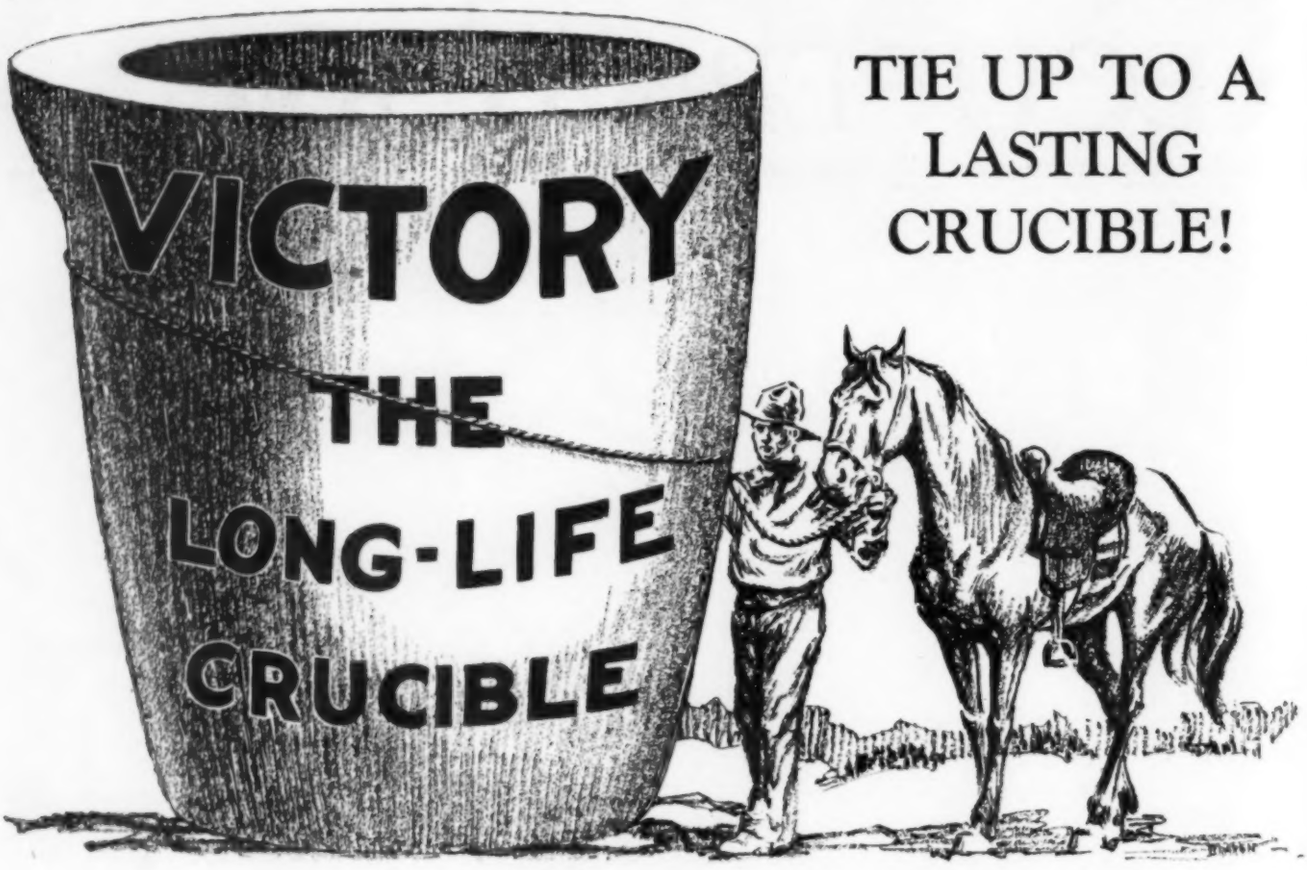
You will be interested in our recommendations for the application of Carborundum Recuperators to various types of metallurgical furnaces, ceramic kilns, glass melting furnaces, etc.

The Carborundum Recuperator is also built with banks of tubes arranged in series whereby the air travels on a horizontal plane thru the recuperator.

Bulletin E-11 illustrates and describes The Carborundum Recuperator in detail.

PERTH AMBOY, N. J., U. S. A.

SILICON CARBIDE. THIS TRADE MARK IS THE EXCLUSIVE PROPERTY OF THE CARBORUNDUM COMPANY.



TIE UP TO A LASTING CRUCIBLE!

—IT LASTS BECAUSE BUILT TO

CRUCIBLE life is, of course, relative. No crucible will last for years, though that's no reason why we should accept a high mortality rate as inevitable. Crucibles *can* be made to last from three to five times as long as most of them do.

By close experimentation with materials and temperatures and processes we developed Victory—a crucible which has never been surpassed for reliability and long life.

Crumbling, the rapid wearing away in use, is a common fault of most crucibles. The elimination of rapid deterioration is a large factor in the long life of Victory Crucibles.

There is real saving in the use of Victory, saving in material, time and production. A test is inexpensive. Try it.

LAWTONITE
GRAPHITE AND CLAY
PRODUCTS
TRADE MARK
REG. U.S. PAT. OFF.

JONATHAN BARTLEY CRUCIBLE CO.
TRENTON, N. J.

Francis Wagner
307 San Francisco St.,
El Paso, Tex.

E. D. Bullard Co.
565 Howard St., San Francisco, Cal.

A. C. Moulton
206 S. W. Temple,
Salt Lake City, Utah

D. M. Hamilton
3201 Lawrence Ave., Detroit, Mich.

W. T. Withers Supply Co.
962 Atlanta Trust Bldg., Atlanta, Ga.

A
big
business,
like a pyra-
mid, must rest
on a solid founda-
tion. That foundation
is the confidence it in-
spires. ¶ Heat Transfer
Products, Inc., is an engi-
neering and manufacturing com-
pany composed of men, each of
whom has won his spurs in the field
in which he works. Many of them already
have won your confidence by serving you
well during their former connections. ¶ Hand-
picked from the vineyard of experience, these men
—whether they design or deliver, produce or sell—
are now banded together for the purpose of continuing
their efforts with renewed vigor. ¶ Backed by the largest
organization producing heat transfer equipment, they bring
to you the results of thirty-three years of manufacturing ex-
perience. And their sole aim is to serve you better than ever
before, if that is possible, and to continue to merit and hold your

CONFIDENCE

Engineering data and estimates will be gladly furnished on equipment for the following applications:

Power Plants	Gas Plants	Refrigeration
Oil Refining	Air Conditioning	Textile Mills
Chemical Plants	Heating and Ventilating	Laundries, etc.

Send for information on the type of apparatus in which you are interested.

HEAT TRANSFER PRODUCTS, Inc.

A Division of the

STATEN ISLAND SHIPBUILDING CO.

90 West Street, New York

Quick Relief... for "heat needy" plants!

Whether you need heat at one or a dozen points—these heaters insure "double-quick" installation, low initial and operating costs!

A HEATER of exceptionally high efficiency—that can be quickly and economically installed. Such is the Sturtevant Design No. 3 Unit Heater.

If you need more heating equipment at once—must get it into operation quickly—here is a heater which will meet your requirements, whether you have a whole building or floor to heat or merely several cold spots.

Simple Installation

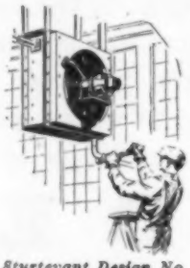
Place this Sturtevant Unit Heater in position, on the floor or overhead, connect steam and return mains, attach wires to electric motor—and it's ready for service.

Sturtevant Design No. 3 Floor Type Unit Heater

No assembling to do. No alterations to building. Quick, easy installation — and only a small amount of piping required.

High Efficiency

Sturtevant Unit Heaters because of their many advantages are rapidly replacing less efficient and more expensive heating equipment in industrial plants everywhere. They have five times the heating capacity of direct radiation, are light in weight, require but a small amount of installation space and their initial and operating costs are low.



Sturtevant Design No. 3 Overhead Type Unit Heater

Directed Heat

The motor-driven fans with which these heaters are equipped keep the warm air constantly in circulation and drive it to where it is needed—where employees are working.

With Sturtevant Unit Heaters there are no *cold* floors and *warm* ceilings—no "spotty" heating. Draft-swept areas and other points which ordinarily defy warmth are easily kept comfortable.

Mail the Coupon for Complete Information

The coupon below is for your convenience. Mailing it will immediately bring you a copy of our Catalog 339 containing full information and photographs of many typical Sturtevant installations.

Our engineers, who are constantly coping with industrial heating problems, have a wealth of experience which they would be glad to place at your disposal. Feel free to call on them for advice or for assistance in planning any heating installation which you may be contemplating.

B. F. STURTEVANT CO., (Mail to Nearest Office).

☐ Please send me a copy of your Unit Heater Catalog No. 339.

☐ Please have your representative call.

Name .....

Company .....

Address .....

.....

C.12-27

B. F. STURTEVANT COMPANY, HYDE PARK, BOSTON, MASS.

Atlanta	Charlotte	Dallas	Indianapolis	Montreal	Rochester
Boston	Chicago	Denver	Kansas City	New York	St. Louis
Buffalo	Cincinnati	Detroit	Los Angeles	Pittsburgh	San Francisco
Camden	Cleveland	Hartford	Minneapolis	Portland	Seattle
	Toronto			Washington	

Sturtevant REG. U. S. PAT. OFF. ***Unit Heaters***

with the Sturtevant super-efficiency fan

Producing barium sulphide to produce beat sugar

Here's another purpose for Vulcan kilns. At the plant of a large sugar company one is used to convert barium sulphate into sulphide, and two more (see photo above) are on the job revivifying the sulphide after it has been used in the process of making beet sugar.

The two kilns shown—used on revivifying duty—are 8 feet in diameter and 160 feet long. These two kilns are larger than the third, which is for the reduction of barytes for use in beet sugar making process.

Vulcan Engineers are designing kilns and coolers for an increasingly wide range of purposes—in an increasingly wide range of industries—for large, medium and small production.

Perhaps you have a problem, in roasting, drying, hydration, nodulizing, oxidizing, desulphurizing or some other process which requires equipment such as Vulcan designs and makes. If so, get in touch with Vulcan Engineers. They will build the kilns and coolers best suited to lower your operating costs and speed your production. Send for Bulletins.

Vulcan Products

Hoists,
Electric and Steam
Locomotives,
Steam, Gasoline, Electric
Rotary Kilns, Dryers, Coolers and Roasters
Mine Ventilating Fans
Cages and Skips
Sheave Wheels
Coal Crushers
Gray Iron Castings
Open Hearth Steel Castings
Gears, Moulded and Cut Teeth
Special Machinery

VULCAN IRON WORKS

Established 1849

1742 Main Street, Wilkes-Barre, Pa.

New York Office:
50 Church Street

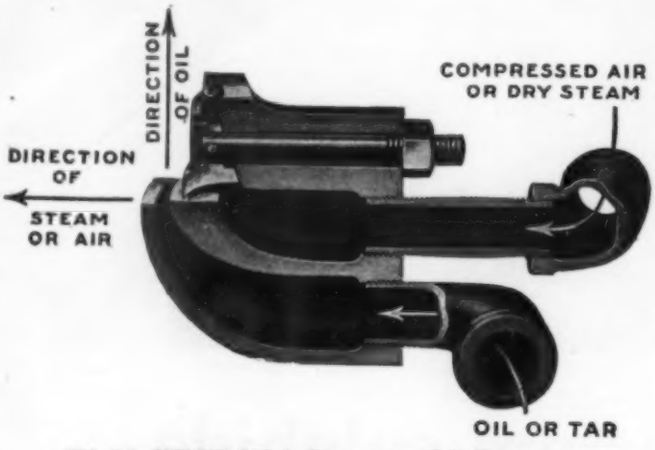
Chicago Office:
McCormick Bldg.

VULCAN of WILKES-BARRE KILNS

W. N. BEST Oil Burners

for every industrial use

THE cut below shows the external atomizing principle of W. N. Best Oil Burners. Thorough atomization is obtained with these burners, which accounts for the efficiency and economy of complete combustion with even heat distribution.



W. N. BEST High Pressure Oil Burner

For over 36 years the W. N. Best Corporation has been engaged in the manufacture of oil burners, strainers, heaters, pumps, complete fuel oil pumping and heating units and all specialties required in modern oil systems.

The application of a W. N. Best Burner to your equipment is soundly engineered insuring satisfactory results.

Your inquiries for Oil Burning Equipment are solicited. Catalogues sent on request.

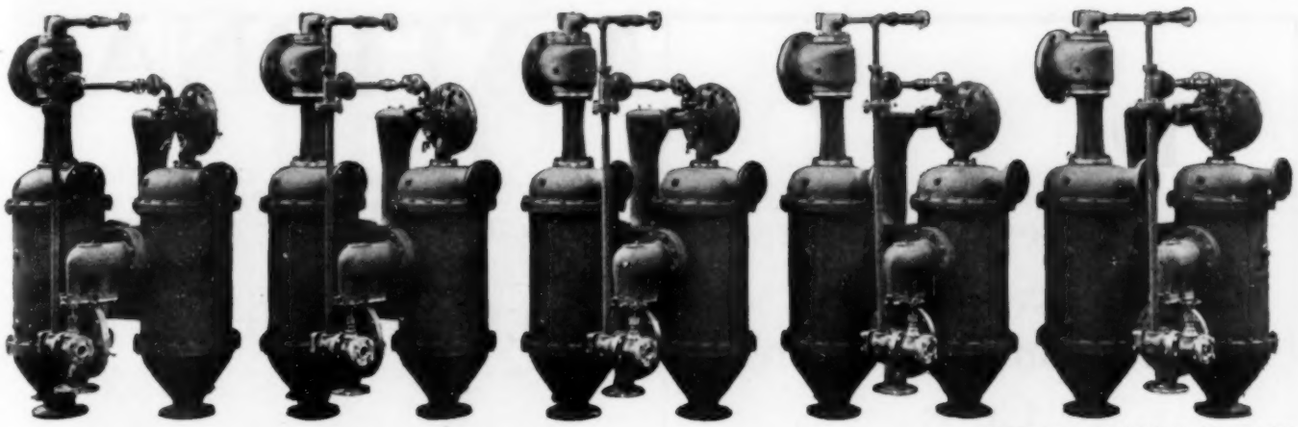
W. N. BEST CORPORATION
Engineers and Manufacturers Since 1890
101 West 31st St., New York City

Three Hundred Wedge Furnaces

are operating in the United States and Canada, drying and roasting numerous ores, concentrates, mixtures and materials. Practically all of these are LARGE UNITS. Wedge Furnace features insure continuous operation and make it unnecessary to install spares or a number of small units in order to maintain steady production.

Write us fully regarding your roasting problem

BETHLEHEM FOUNDRY & MACHINE CO.
BETHLEHEM PENNSYLVANIA



Three-stage Radojet Air Pumps for producing vacuum in high vacuum oil stills, supplied to a large oil refinery.

High Vacuum *and* Pressure Distillation Equipment

In addition to the Leach Fracto Control Condenser, we manufacture a complete line of high vacuum and heat exchange equipment for refineries and other industrial plants employing distillation in their processes.

Effective heat transfer, ranking equally in importance with high vacuum, has claimed our close attention for many years. The result is a knowledge of the factors affecting this subject that make the C. H. Wheeler line of heat exchangers both comprehensive and highly efficient.

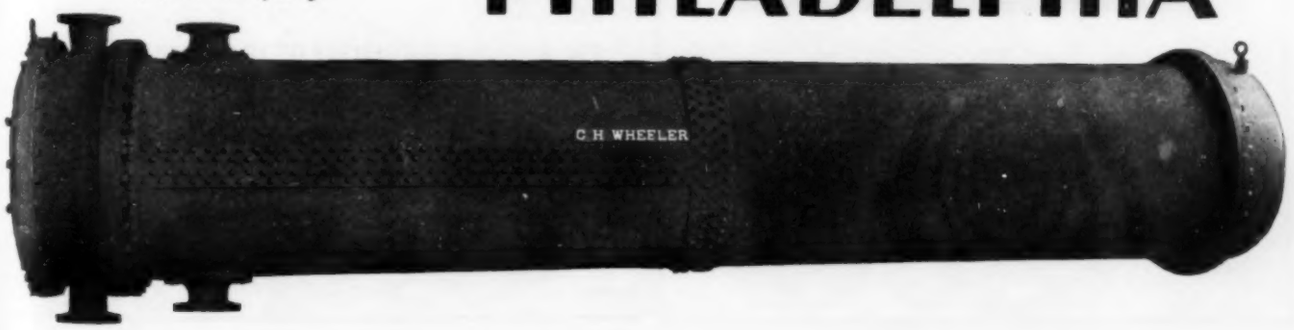
We solicit your inquiries in regard to heat exchange and high vacuum equipment, and will be pleased to figure on the proper apparatus for any specific installation whatever its nature.

We manufacture:
Surface, Jet and Barometric Condensers; Leach Fracto Control Condensers; Oil Vapor Condensers for High Vacuum Distillation; Heat Exchangers; Sand Separators; Radojet Air Pumps for vacua up to 29.95 inches; Forced and Natural Draft Cooling Towers.

C. H. WHEELER MFG. COMPANY
19th St., Lehigh & Sedgley Aves.
Philadelphia, Pa.

C. H. WHEELER of PHILADELPHIA

Heat exchanger for a large eastern oil refinery.



D F C

Crucibles, Scorifiers Muffles, Roasting Dishes and Annealing Cups

LEADERSHIP

Faithful adherence to high principles, backed by well directed tireless effort, wins *leadership.* The trade mark DFC on Metallurgical Clay Products is the mark of such a leadership, acquired through years of constant endeavor to produce the finest that money can buy.

The ideal of perfection governs every step in their production from raw materials to finished product.

The natural result is a world-wide popularity—and ever-growing demand. That is success . . . that is LEADERSHIP.

THE DENVER FIRE CLAY COMPANY

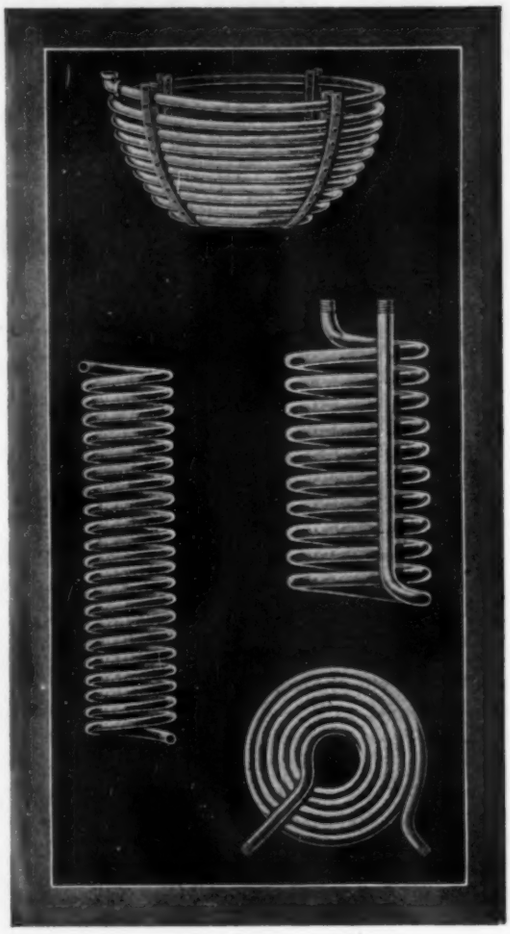
DENVER DFC COLORADO

EL PASO

SALT LAKE CITY NEW YORK CITY

NATIONAL COILS

and Heat Exchange Apparatus for the CHEMICAL INDUSTRY



Finely made coils are but a part of National Pipe Bending Co.'s production. We can furnish you special **heat exchange apparatus,** such as instantaneous heaters, preheaters, etc., equal in quality to National Coils. National products are known for their good service throughout the leading industries of the country.

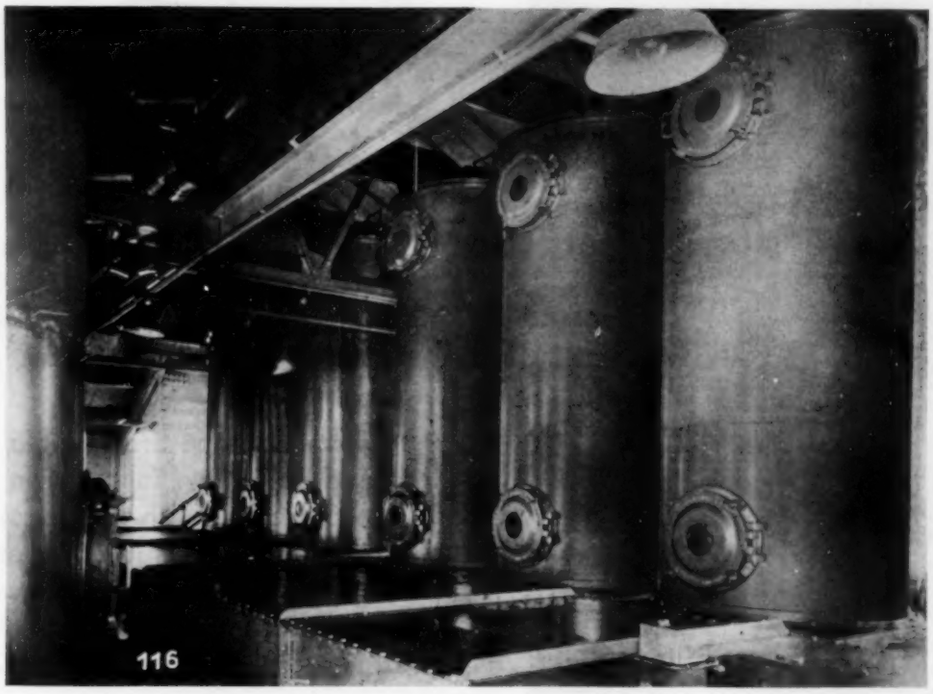
Let us go over your specifications, or send representative to call. Quotations furnished promptly.

The National Pipe Bending Co.

Established 1883 140 River Street

NEW HAVEN, CONN.

Boston New York Philadelphia



Making Waste Heat Work DRACCO Does It

That's exactly what Dracco is doing for this manufacturer.

In this installation the heat radiated from two rotary kilns is conveyed to the pulverized coal dryers for drying all coal used in this plant.

Two large hoods are located over the hottest part of the kilns and Dracco Filters draw the heat through them to the dryers.

This is a new use for heat usually wasted and may suggest a use for waste heat in your own plant.

Dracco Engineers will be pleased to discuss any possibilities you may have at your suggestion.

Write for an interview or for fully descriptive bulletins.

THE DUST RECOVERING & CONVEYING CO.

Engineers and Manufacturers

Harvard and East 116th St. Cleveland, Ohio

DRACCO DOES IT

Southwestern Absorbers on a high pressure gas line.

SOUTHWESTERN ABSORPTION TOWERS

POSITIVE contact of the gas and oil in counter current flow through the tower with the oil held at a constant level, assures efficient stripping of the gas.

Higher gas flows are possible without increased velocity. In addition to this large overload factor, there is the advantage of having no lower limit restriction to capacity, due to the fact that the gas orifices are always sealed by a body of oil. The result is a tower of great flexibility.

SOUTHWESTERN ENGINEERING CORP.
HOLLINGSWORTH BLDG.
Los Angeles, Calif.

Branches:
637 Mayo Bldg., Tulsa, Okla.
Western Bldg., Amarillo, Tex.

Branch:
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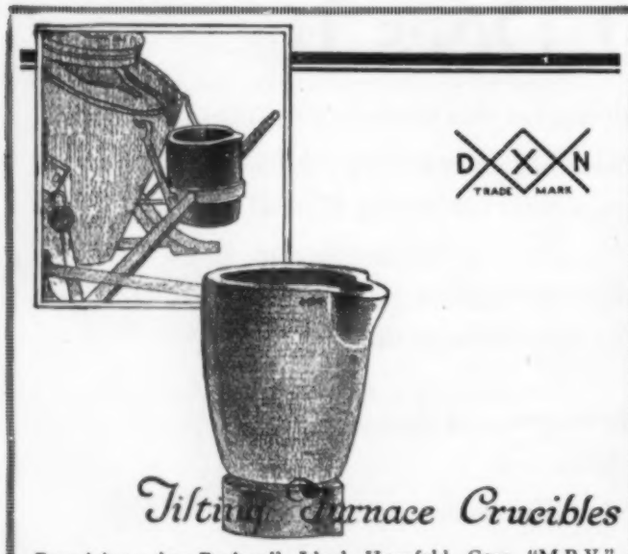
Joplin, Missouri

90 WEST STREET . . . . . NEW YORK



Tilting Furnace Crucibles

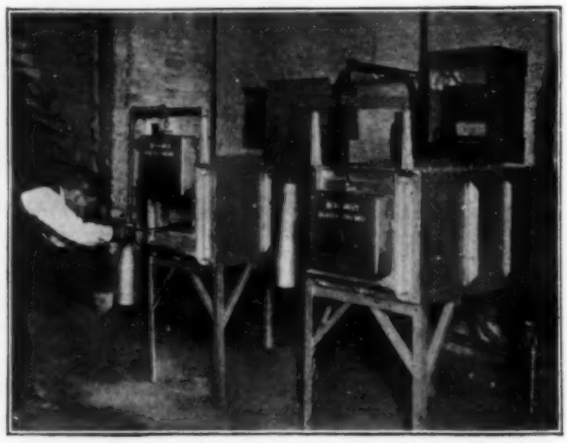
Foundries using Rockwell, Ideal, Hausfeld, Case, "M.R.V." Monarch or other tilting furnaces will find Dixon's Tilting Furnace Crucibles and Bases for same dependable and economical. The name DIXON on *any* crucible gives assurance that it is the *standard* and is backed by nearly a century of experience in crucible manufacture.

DIXON GRAPHITE CRUCIBLES

Write for Bulletin 243A in which are illustrated the full line of Dixon Graphite Crucibles, their sizes and capacities.

JOSEPH DIXON CRUCIBLE COMPANY
Jersey City, N. J., U. S. A.
1827 *One Hundredth Anniversary* 1927

HEVI-DUTY TOOL ROOM FURNACES



Your Laboratory, Tool Room and Factory can be completely equipped with Hevi-Duty Electric Furnaces.

Send for our Catalogs.

HEVI DUTY ELECTRIC COMPANY
"Hevi-Duty" and "Multiple Unit" Furnaces
MILWAUKEE, WIS.

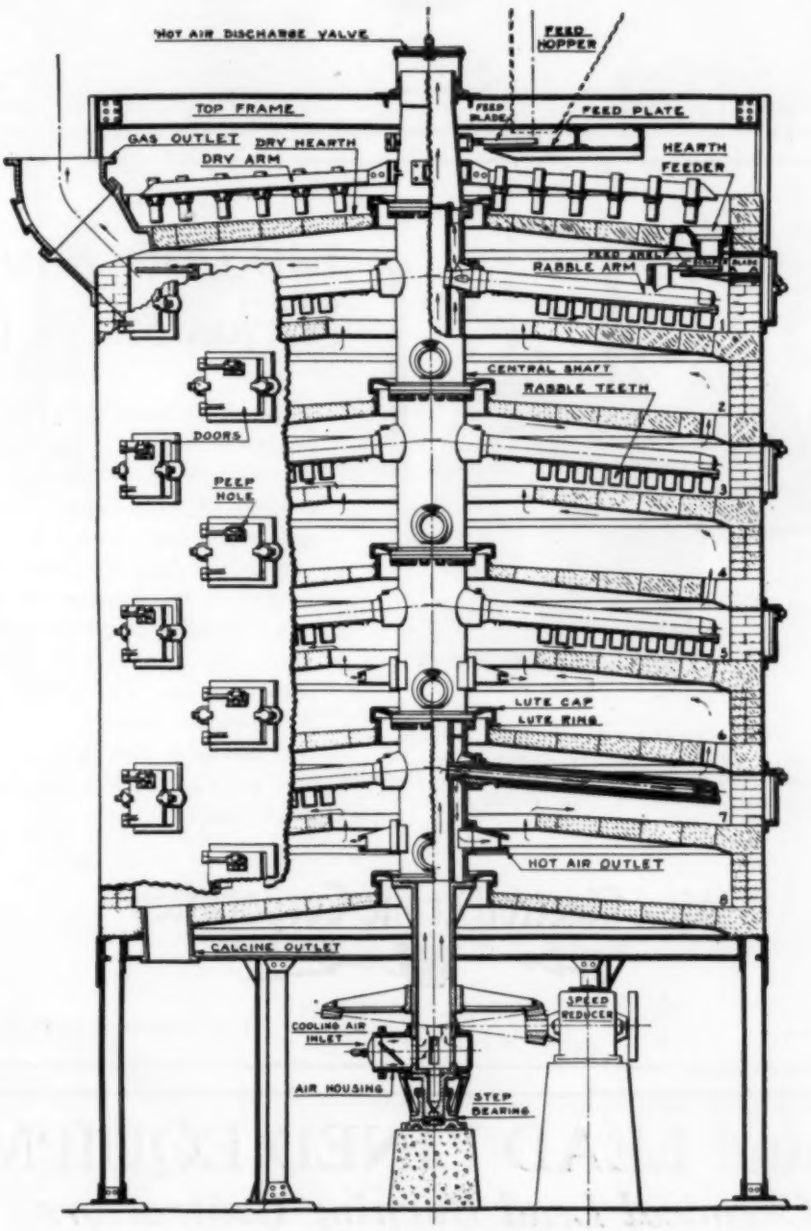
New York
Detroit
Philadelphia
Pittsburgh

Formerly
Electric Heating Apparatus Co.
Newark, N. J.

Chicago
St. Louis
Cleveland

Nichols Herreshoff Furnace

Economical Roasting, Drying and Calcining



Send for our new Bulletin No. 200

NICHOLS COPPER COMPANY
25 Broad Street
NEW YORK, N. Y.

PACIFIC FOUNDRY COMPANY
18th and Harrison Streets
SAN FRANCISCO, CALIFORNIA

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Metallbank und Metallurgische Gesellchaft, Frankfurt, a. M., Germany

Mitsuf & Co., Tokio, Japan.

THE BABCOCK & WILCOX COMPANY

85 LIBERTY STREET, NEW YORK

Builders since 1868 of Water Tube Boilers of continuing reliability

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PHILADELPHIA, Packard Building
PITTSBURGH, Farmers Deposit Bank Building
CLEVELAND, Guardian Building
CHICAGO, Marquette Building
CINCINNATI, Traction Building
ATLANTA, Candler Building
PHOENIX, ARIZ., Heard Building
DALLAS, TEX., 2001 Magnolia Building
HONOLULU, H. I., Castle & Cooke Building
PORTLAND, ORE., 805 Gasco Building

WORKS

Bayonne, N. J.
Barberton, Ohio

Makers of Steam Superheaters since 1898 and of Chain Grate Stokers since 1893

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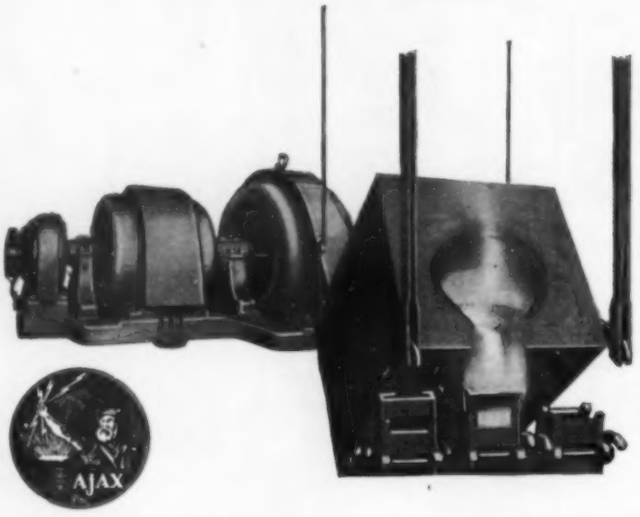
NEW ORLEANS, 344 Camp Street
HOUSTON TEXAS, Southern Pacific Building
DENVER, 444 Seventeenth Street
SALT LAKE CITY, 405-6 Kearns Building
SAN FRANCISCO, Sheldon Building
LOS ANGELES, 404-6 Central Building
SEATTLE, L. C. Smith Building
HAVANNA, CUBA, Calle de Aguiar 104
SAN JUAN, PORTO RICO, Royal Bank Building



The above illustrates a 600 K. W. Motor Driven High Frequency Generator Set now in successful use for melting special alloys. For example, in one plant twelve furnaces of the above type are operated from two such generators, and are melting 140,000 pounds of nickel silver per day.

140,000 pounds of Nickel Silver per day

The Ajax-Northrup High Frequency method of heating is applicable not only in the research laboratory, but also for large commercial applications. The special products or processes worked out in the laboratory by the Ajax-Northrup high frequency method of heating may be afterward put into production on a large commercial scale. With the type furnace illustrated it is possible to pour 250 pounds of steel every 22 minutes, without any accompanying heat, smoke or dirt, thus assuring purity of the metal and comfortable working conditions.

Ajax Electrothermic Corporation

Trenton, New Jersey

G. H. CLAMER, *President* E. F. NORTHRUP, *V. Pres. & Tech. Adviser*

LEAD and LEAD LINED EQUIPMENT

Chemical Lead Burning Contractors

Acid Chambers and Towers, Lead Lined Tanks, Lead Linings for Tanks, Vats, etc. Lead, Condensing, Cooling and Heating Coils, Lead Sleeves, Agitators, Lead and Lead Lined Pipe and Fittings.

Pure Tin Linings and Coil for vessels of every character.

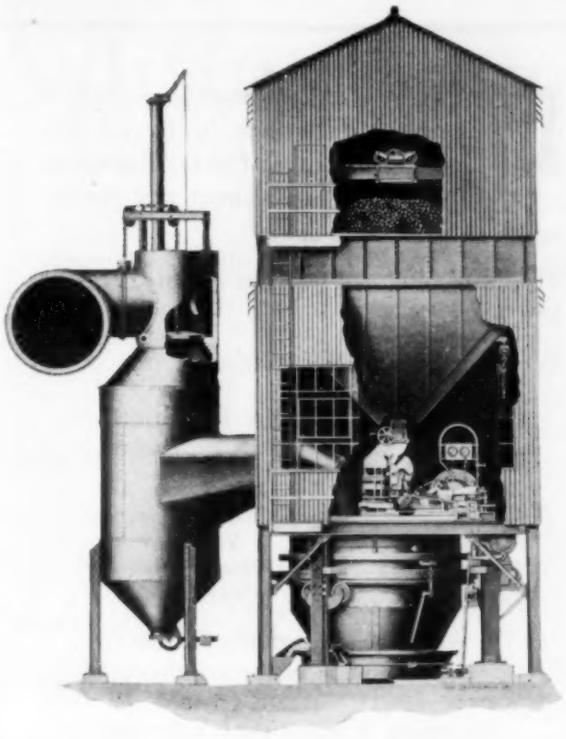
Specialists in Chemical Lead Burning, experienced in design of Chemical Equipment made of lead, and made to meet your specifications and requirements.

Our products cover practically everything in the chemical line where lead is used.

JOHN F. ABERNETHY & CO., INC.

708-710 Myrtle Ave. Brooklyn, N. Y.

Established 1901



Better Gas and Rising Standards

Production and quality standards are constantly rising. What was epochal 20 years ago, isn't good enough today.

There are many old gas producers in various industrial plants. Usually they operate without undue difficulty. But they cannot keep pace with the rapid march of progress.

The W-S-M Producer generates gas in a steady flow—uniform in volume and quality—which is so important in modern production schemes.

Coal feed—ash removal—poking—all are automatic. Labor is reduced to relatively easy supervision.

Rates of gasification are higher per square foot of area, reducing capital expense.

Economies permitted, better gas produced make it well worth while to replace old producers with these fine new machines.

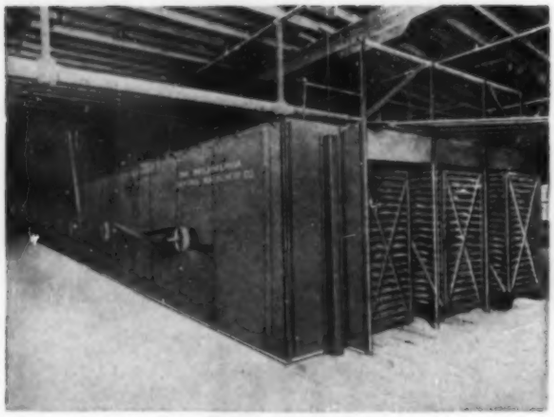
THE WELLMAN-SEAVER-MORGAN CO.

ENGINEERS CONSTRUCTORS MANUFACTURERS

Cleveland, Ohio

New York at 522 Fifth Ave., Birmingham at 1101 American Trust Bldg.

In Canada—"Canadian Wellman-Seaver-Morgan Co., Limited," 307 Reford Bldg., Toronto—808 Drummong Bldg., Montreal



"HURRICANE" Dryers
Used Where Accurate Temperature Control Is Essential

A TYPICAL drying process, where accurate regulation of temperature is essential, is the drying of Stearate of Zinc. If the temperature rises above 192°F. in any part of the Dryer, the Stearate of Zinc will melt to a soapy mass, absolutely useless. On the other hand, if the temperature falls more than a few degrees below the melting point, the time required for drying is greatly increased and production retarded.

"HURRICANE" Dryers in one plant reduced the time of drying Stearate of Zinc from 50 or 60 hours, to 30 hours. No spoilage was encountered.

The "HURRICANE" System of drying by warm air recirculated through the drying chamber, under Automatic Control of Temperature, secures uniform drying throughout the machine.

Truck Dryers,
Progressive Tunnel Truck Dryers,
Continuous Conveyor Dryers
of any size or capacity required

THE PHILADELPHIA DRYING MACHINERY CO.
Stokley Street, above Westmoreland, Philadelphia, Pa.
New England Office: 53 State St., Boston, Mass.

Southern Agents: Carolina Specialty Co., Charlotte, N. C.

HURRICANE
Ideal Drying Every Day

Canadian Agent: C. M. Cudlip, Hamilton, Ont.

63

WE HAVE taken four large evaporator installations in Brazil this year, in the face of bitter European competition, and that without any preferential tariff to help us.

This business was won on *quality, service* and *price.*

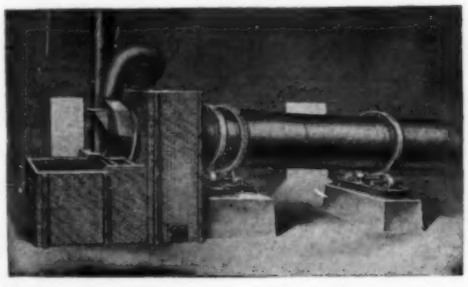
We offer you these facilities.

Joubert & Goslin Products

Evaporators	Settlers
Stills	Saturators
Retorts	High Duty Rotary Vacuum Filters
Condensers	Heavy Chemical
Dryers	Casting
Kilns	

We have one of the largest copper shops in the country.

JOUBERT & GOSLIN MACHINE & FOUNDRY CO.
BIRMINGHAM
New York Office, 82 Beaver Street
Cable Address "JOUGOS"



Success or Failure in your Plant depends largely on the proper selection of equipment.

We design and manufacture:—

Christie Rotary Dryers and Calciners

Shaft or Rotary Lime Kilns

Mechanical and Hand-Poked Gas Producers

Steel Tanks and Stacks

Steel Plate Construction of All Kinds

Adopt our Recommendations—
It's Safer

DUFF PATENTS CO., INC.
320 Union Trust Bldg., Pittsburgh, Pa.

A diffusion system that evenly distributes the heat!

This is one of the characteristics that has given Freas Electric Ovens world wide industrial plant and laboratory acceptance.

Ever look inside of a Freas Oven—a Process or a Laboratory type? There you will see a system of diffusion plates each punched with various sized holes. Both the size and the location of these holes are determined with scientific accuracy so that every part of the drying chamber—top, bottom, front, and rear—register the same temperature.

Where really exact control is a pre-requisite, you can put your full confidence in the Freas. You will know that when a lot is run into a Freas Oven, it will come out *evenly* dried. Where such exact results are not necessary, you can increase the quality of your product at no additional expense.

How ever you look at it—cost of installation; cost of operation; quality of product; drying time; all of these combined represent dollars and cents advantages that you should be fully posted on.

For you—

Complete construction and operating details are yours for the asking on the whole Freas line of ovens which includes types and sizes to meet practically any laboratory or plant need.

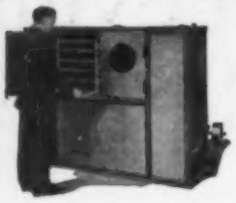
The process types of ovens are being used for baking enamels, japans, and lacquers, armature cores after impregnation, for testing rubber, paints and varnishes, for drying leathers, and textiles, for vulcanizing rubber, and for succesfully baking or drying at room pressures or under vacuum, scores of other products.

The THERMO ELECTRIC Co.
Instrument

1206 So. Grove St., Irvington, N. J.

Automatically Controlled

ELECTRICAL OVENS



—from tray dryers for small batches, to continuous drying systems for vast production—

Proctor Dryers!

DRYERS *for* INDUSTRIES

Types for many materials — efficient units for any production scale—built by specialists (since 1883) in mechanically applying natural drying with every legitimate economy.

PROCTOR & SCHWARTZ, INC.
PHILADELPHIA

DEGASIFYING AND ANNEALING FURNACE wound with molybdenum or tungsten. With or without cooling chamber. HIGH TEMPERATURE with low current consumption.

We also furnish tungsten and molybdenum wire and rods in any size. We specialize in fine wire drawing of any metal down to .0005-inch.

We also equip complete plants for high vacuum work, and we maintain a laboratory for work in connection with high vacuum, rare gases, and glass blowing.

RADIO ELECTRICAL WORKS
23 Union Square, New York, N. Y.

Mettler Entrained Combustion Gas Burners

FOR ALL Purposes
Kinds of gas
Pressures

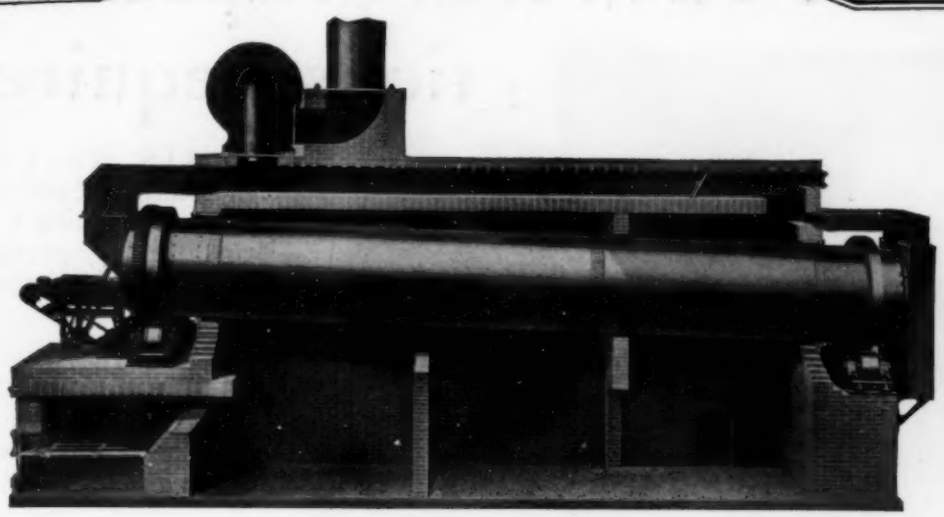
406 S. Main St. **LEE B. METTLER. CO.** Los Angeles Cal.

MORGAN POKERLESS PRODUCER-GAS MACHINES

embodying important improvements will shortly be ready for delivery. These improvements not only retain the
SUPREME RELIABILITY
which has been the leading characteristic of these splendid Machines for the past 14 years but in addition they assure in regular service

Great Increase in Capacity.

Morgan Construction Company
Worcester, Mass.



A four compartment cylinder—75% more heating surface—less power for rotation.

When Your Drying Job is Different

When your drying job is different—unusual—difficult—you'll get just the right helpful co-operation from Bartlett-Snow.

Here you have access to an experience of more than thirty years in the building of drying equipment. A wealth of drying information is at your disposal. The accumulated experience and information often enables us to make recommendations that we are willing to back up with performance guarantees even on unusual requirements.

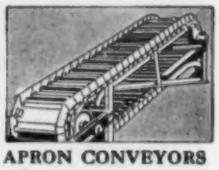
During recent months we have served people like Thomas A. Edison, Inc., Procter and Gamble Co., Canada Bureau of Mines, on difficult problems. The same service is available to you without obligation.

Bulletin No. 51 which illustrates many Bartlett-Snow drying installations is mailed free upon request. Send for your copy today.

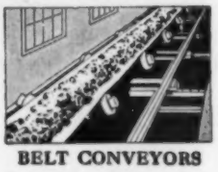
THE C. O. BARTLETT & SNOW CO.
6204 Harvard Ave. Cleveland, Ohio

SKIP HOISTS

BUCKET ELEVATORS

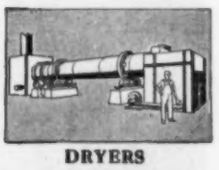


APRON CONVEYORS

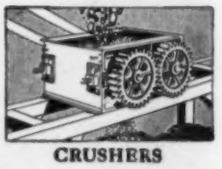


BELT CONVEYORS

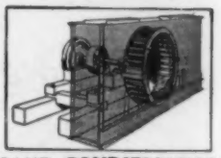
SCREW CONVEYORS



DRYERS



CRUSHERS



SAND CONDITIONERS

Bartlett - Snow

13 Standard Types DRYERS for Many Requirements

1200% Safer Than I. C. C. Specifications Require

THIS Hackney Seamless Steel Barrel is undergoing a hydrostatic test pressure of *480 pounds per square inch.*

Notice how this extreme pressure has pushed up the head. But there was *absolutely no sign of leakage.*

Now look at I. C. C. Shipping Container Specification No. 5. It requires only 40 pounds per square inch. But this Hackney Barrel was given 480 pounds—*1200% more than required.*

Because of such performance—not only in tests, but in actual use — Hackney Seamless Steel Barrels are everywhere gaining the reputation of being the safest, surest, and cheapest means of liquid transportation.

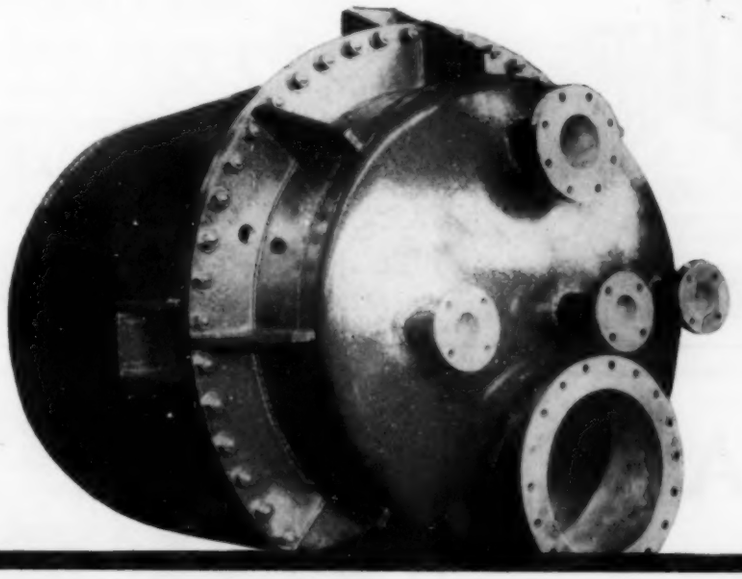
Hackney Barrels can make more round trips without leakage, without spoilage, and without damage. Patented head chime construction and seamless bodies make them extra strong and leakproof—make them 1200% safer than I. C. C. Specifications require as this test proves. Patented Raised Openings give further protection against both leakage in and leakage out.

If you are looking for safer, stronger, hardier barrels — barrels that can lower your shipping costs—mail us your name and address. We will send you complete information and quotations without obligating you in any way.

PRESSED STEEL TANK COMPANY

1149 Continental Bank Bldg. - - - - Chicago
1325 Vanderbilt Concourse Bldg. - - New York City
5709 Greenfield Avenue - - - Milwaukee, Wis.

Hackney
MILWAUKEE



HOMOGENEOUS LEAD LINED CHEMICAL APPARATUS

The jacketed steam kettle illustrated is only one of many types of lead lined equipment which we build for the Process Industries.

Homogeneous lead lining has the advantages of permitting the best possible heat transmission and will not creep, buckle or loosen under the most trying operating conditions.

This type of lining is particularly well adapted to the construction of large units of equipment.

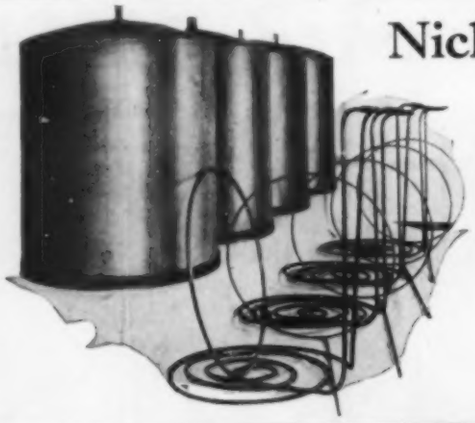
Partial List of Products

Vacuum Evaporators	Cooling and Heating Coils
Vacuum Tanks	Car Tanks
Vacuum Pans	Digesters
Steam Jacketed Kettles	Autoclaves
Internally Heated Kettles	Acid Eggs
Stills	Agitators

Chemical Equipment Mfg. Co.

Samuel Smith & Son Company

150 Railroad Ave., Paterson, N. J.



Nickel and Monel Metal Equipment
(solid or lined)

We are specialists in building and relining all kinds of tanks, chlorinators, crystallizers, retorts, blow cases, vacuum pans, etc., in Monel and Nickel, Copper, and many other metals and alloys.

Our experience in this class of work has been very extensive. Let us quote on such equipment and fittings. *Prompt service.*

Liberty Coppersmithing Co.
1708 N. Howard St., Philadelphia, Pa.

MONARCH

of

Brass—Iron—Steel
Rubber—Stoneware,
Etc.

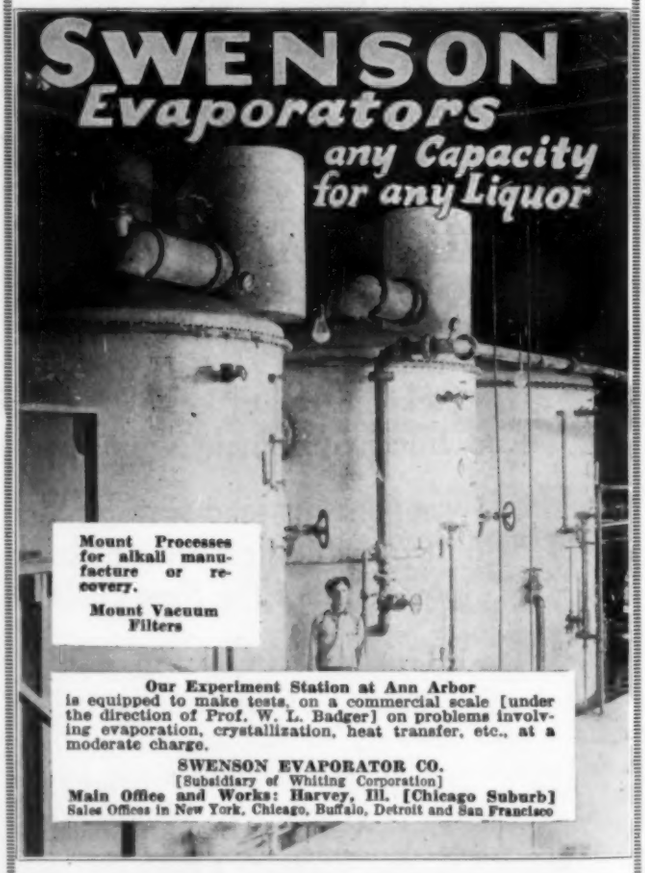
for

Any Acid or Gas

Write For
Catalog 6-C

Monarch Mfg. Works, Inc.
2730 E. West Moreland St.
PHILADELPHIA, PA.

SPRAYS



Perrin Filter Presses—Plates—Frames

Filter Presses for all filtration and separation operations using Plates or Plates and Frames of metal or wood.

Perrin Presses may be furnished with hand or power closing mechanism.

Iron Recessed Plate Press

Recessed Plate | Cake Frame | Flat Plate

We have patterns for all sizes of recessed Plates in either square or round types, also for flat Plates and extension cake Frames, on which handles can be altered, if necessary, to suit other Presses.

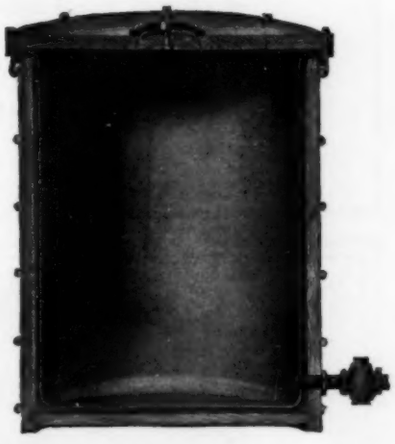
We can make up all sizes of wood flat Plates and wood extension cake Frames according to the specifications received.

WILLIAM R. PERRIN & COMPANY
36 W. Van Buren St., Chicago, Illinois

Most tanks look alike to the inexperienced . . .

but there's a vast difference

IT would be quite difficult for the average person to distinguish between two tanks unless he was acquainted with the peculiarities of the various woods and the best method of construction. He must also know all about the service for which the tanks are intended.



Such matters as dryness of the wood, kind of wood, correct design, proper jointing for the particular service the tank is to give. Selection of proper metal parts, corrosion resistance, what kind of lining (if to be lined), are not usually understood by the average tank user, but have been closely studied, and are well understood by us.

Our new catalog is a text-book on wooden tanks. You should read and study it before deciding on wood tanks.

Hauser-Stander builds wood tanks for every purpose and will be glad to look into your needs and help you specify the tank for your particular service.

Wood tanks in Genuine Red Gulf Cypress, Long Leaf Pitch Pine or Douglas Fir as specified, lined or plain in any size or shape; for hot oils, paints, acids, dyes, soaps, inks, or any other chemical product.

THE HAUSER-STANDER TANK CO.

MANUFACTURERS OF

WOOD TANKS FOR EVERY PURPOSE

CINCINNATI

3 OUTSTANDING ADVANTAGES

ACE Hard Rubber Equipment and Equipment lined and covered with ACE Hard Rubber for chemical processes, has very decided advantages—

1 —The chemical inertness of ACE Hard Rubber—
as you probably know, makes it completely resistant to most acids or alkali solutions ever present or used in processing. It is a really acid-proof material and it is non-absorbent, too.

2 —The structure of ACE Hard Rubber—
ACE Hard Rubber has no cellular structure in the sense that wood and other materials have. Most active acids and strong alkalis do not react with ACE Hard Rubber. Moreover, ACE Hard Rubber Equipment is strong and built for hard and continuous usage. It is proof against leakage and corrosion.

3 —The Cost—
As ACE Hard Rubber Equipment does not require replacement and heavy repair expenses, the first cost is really the last cost. ACE Hard Rubber Equipment is easily installed, practical and inexpensive.

ACE Hard Rubber Equipment for chemical processes may be obtained for almost any purpose.

AMERICAN HARD RUBBER COMPANY
11 Mercer Street, New York, N. Y.

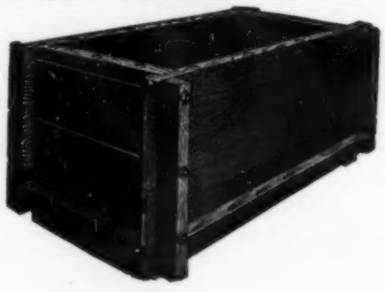
Miller

Rubber Lined Drums for Acid Handling

reduce tare weight, freight rate, loss and damage and storage space.

Ask us about our rubber-lined steel and wood storage tanks

THE MILLER RUBBER COMPANY of N. Y.
AKRON, OHIO



Tanks for all purposes

—built of Redwood or Fir lumber. Made any size or shape. Hooped off or bolted with MONEL METAL when desired.

We also manufacture dye vats, water tanks, etc.

Write for catalogues containing capacity tables and other data.

Pacific Tank & Pipe Co.
334 Market St., San Francisco
103 Park Ave., New York
417 Kearns Bldg., Salt Lake City

Pacific Tanks

Fire Protection means more than Insurance

FIRE insurance will replace property. It will not prevent fire and it will not replace the loss of business, good will, personnel, etc., resulting from a bad fire. Many companies, even though "fully insured" are not able to survive such a shock.

You need insurance but more than that you need fire protection. You want to reduce the chance of serious fire in your plant to the vanishing point. An adequate sprinkler system served by a Horton elevated tank offers dependable fire protection. The water is stored above the buildings ready to flow instantly when a sprinkler head opens. This is the vital feature in fire protection for a few minutes' delay may mean the difference between an insignificant blaze and total loss. Insurance rates are lower when you have a Horton Tank and a sprinkler system. Ordinarily this saving alone pays for the installation in a few year's time. The added protection is therefore clear gain. Consult your insurance broker or ask our nearest office for estimates.

Elevated tanks, flat-bottom tanks, standpipes, etc.

The Horton line covers tanks and steel plate construction of many types used in chemical plants. In addition to their value for fire protection, elevated tanks are frequently used for storing water for processing and miscellaneous plant requirements. A single tank can be connected to serve both the sprinkler system and the service lines, if desired. The Horton flat-bottom tanks are also used extensively for storing process water as well as materials in process or raw or finished materials in liquid form. When space is limited, a flat-bottom tank can be located between the legs of an elevated tank. It will pay you to get a Horton quotation whenever you are considering tanks or steel plate construction. There is a standard Horton Tank for almost every need. Address our nearest sales office for information.

CHICAGO BRIDGE & IRON WORKS

Chicago	2124 Old Colony Bldg.	Atlanta	1020 Healey Bldg.
New York	3118 Hudson Terminal Bldg.	Dallas	1605 Dallas National Bank Bldg.
Cleveland	2220 Union Trust Bldg.	San Francisco	1022 Rialto Bldg.

HORTON TANKS

C&M12Gray

ZAREMBA

MEANS, AND ALWAYS WILL MEAN,
THE BEST EQUIPMENT FOR CONCENTRATING SOLUTIONS

The following is a list of the more important solutions being concentrated in Zaremba Evaporators

Acetate of Lime
Acetate of Soda
Animal Stick

Bichromate of Soda

Caustic Soda
Caustic Potash
Copper Sulphate

Disodium Phosphate
Distillery Slop

Ethylene Glycol

Ferrous Sulphate

Garbage Stick
Gelatin
Glucose
Glue
Glycerine

Magnesium Chloride
Magnesium Sulphate
Malt Wort

Milk Sugar

Packing House Stick
Pectin
Peptone
Potassium Carbonate
Pyroligneous Acid

Salt
Silicate of Soda
Soda Ash
Soda Black Liquor
Sodium Arsenate

Sodium Cyanide
Sodium Ferrocyanide
Sodium Sulphate
Sodium Sulphide
Steep Water
Sugar
Sulphate Black Liquor
Sulphite Waste Liquor

Tanning Extract
Trisodium Phosphate

Zinc Chloride

OVER FOUR HUNDRED INSTALLATIONS

ZAREMBA COMPANY
Crosby Bldg. Buffalo, U. S. A.

New York Office: 95 Liberty Street

Pickling Tank
30' long, 5' wide, 2' deep—2250 gals. capacity.
Hol 6% H_2SO_4—180°F.

Woolford Tanks —for Acids

Constructed of Yellow Pine, specially selected stock. All joints of exclusive design and sealed with Woolford Compound.

Rodded through the wood with acid resisting metal.

The tanks can be shipped assembled up to 40-ft. in length—knocked down on any specification.

Mail Address

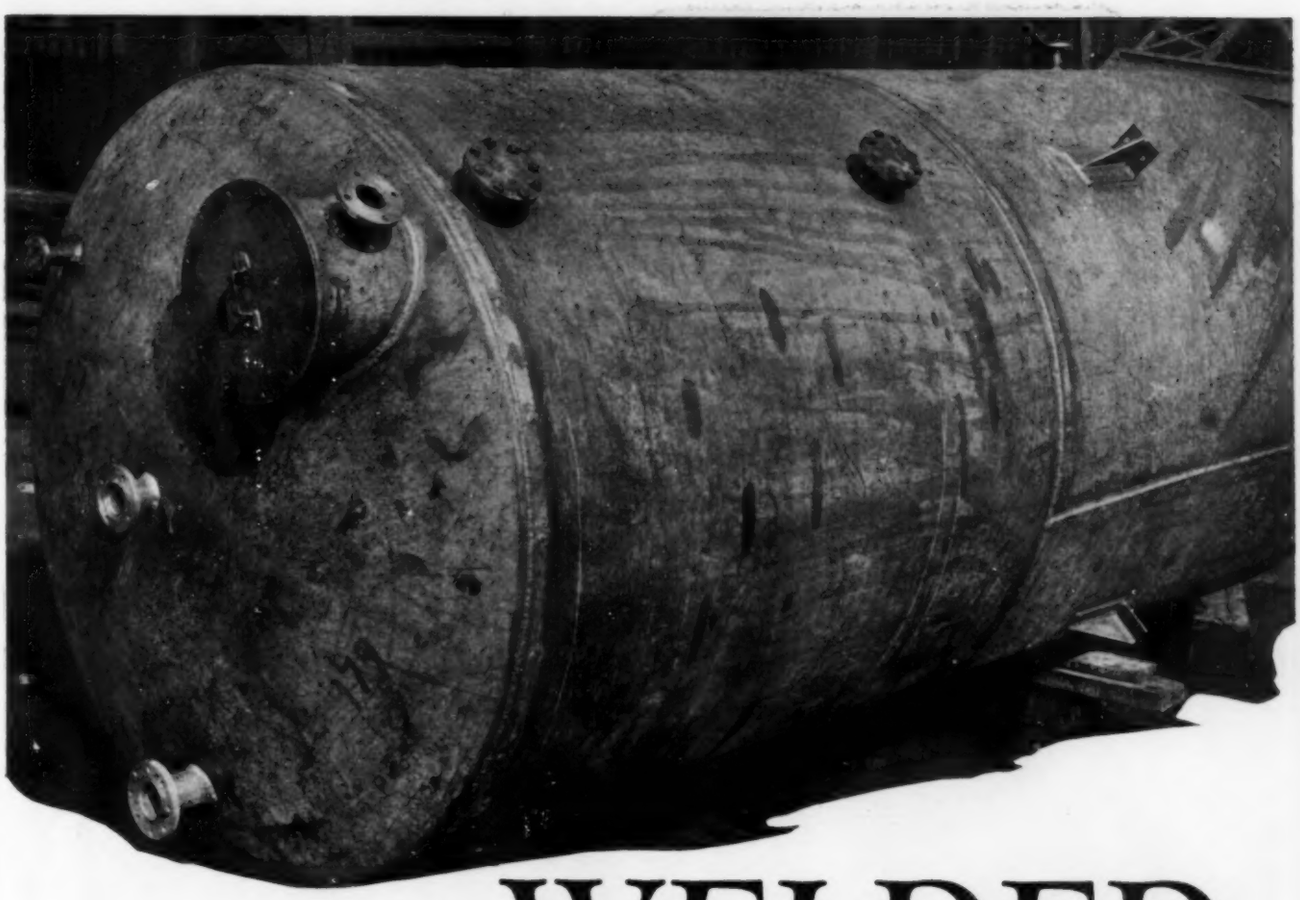
G. Woolford Wood Tank Mfg. Co.
Paschall Post Office, Philadelphia, Pa.
Factory and office, Darby, Pa.

Atlantic Tank & Barrel Corp'n

Wooden Tanks of all descriptions

Tight cooperage Red and White Oak

Tonnele Ave. & Hamblet Place
North Bergen, N. J.



WELDED—

Chromium Iron *and* Stainless Steel Products

Shown on this page is one of the largest nitrocotton digestors ever fabricated. *It is the ultimate in resisting material for Nitric Acid and Nitric Acid Products.*

The process of electric welding developed by this organization for use on the *chromium irons* and *stainless steels* produces sound, nonporous joints which are both ductile and acid resistant. The chrome iron or stainless steel plate is welded without over-heating, and without crystallization. Its physical and chemical characteristics are unchanged.

We have developed *individual methods* for welding each grade and quality of chrome iron, stainless steel, and nickel-chromium alloy. We are prepared to fabricate *by welding* all types of chemical and process apparatus and can *guarantee* a minimum tensile strength of 55,000 lbs. a ductility that bends with or across the weld more than 90° without fracturing, and a resistance to the corrosive action of Nitric Acid under pressure, at any concentration, and at any temperature.

Let us send you samples of any of the well-known makes of Chrome Alloys welded by our special electric welding process. Examine them in your own plant. Put them through any comparative tests you desire—then, you too, will see the advantages of having your process equipment built by us.

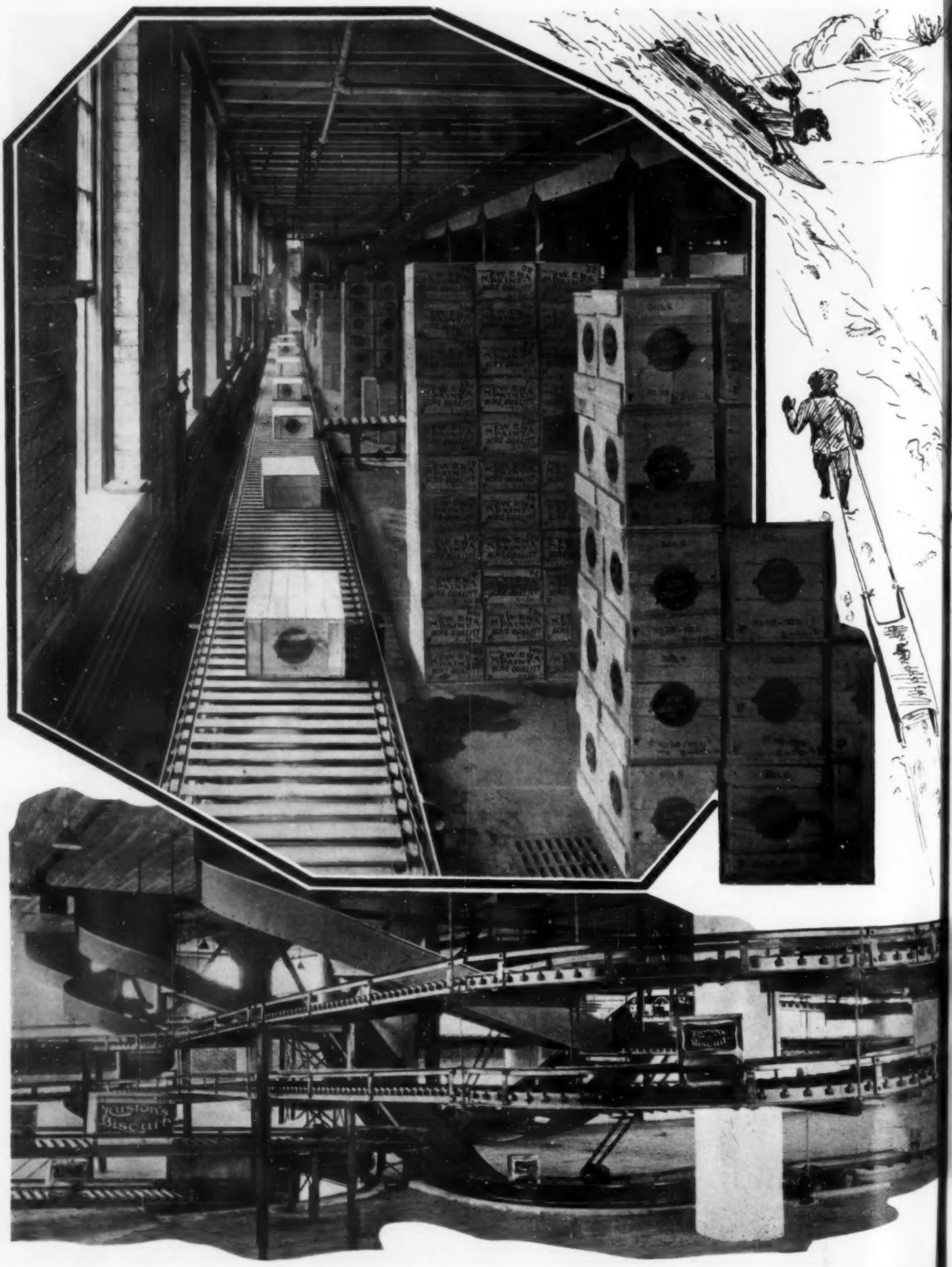
We furnish equipment such as:

Kettles, Vacuum Pans, Digesters, Tanks, Acid Proof Hoods, Nozzle Liners for Cracking Stills and anything in welded plate construction made of: Ascoloy, Avesta, Carpaloy, Delhi, Enduro, Rezistal, Uniloy, Defirust, Duraloy.

Industrial Welded Products Company

Main Office and Plant
Lentz and Roanoke Ave., Newark, N. J.

New York Office
1054 Grand Central Terminal Bldg.


NEW ERA PAINTS
HIGH QUALITY
Huston's Biscuit

Coasting down with an uphill job

The illustration at top of left-hand page shows cases of paint going from storage to shipping floor. This is part of an extensive system of conveyors, consisting of gravity, slat conveyors and incline elevators. Below that is seen an extensive system of Standard Conveyors, mostly gravity, in operation for a Baking Company. This system includes also Spiral Chutes and Roller Conveyors. As an example of the ingenious arrangements that can be effected a spiral chute is seen coming from an upper floor and connecting with a gravity system on a lower floor.

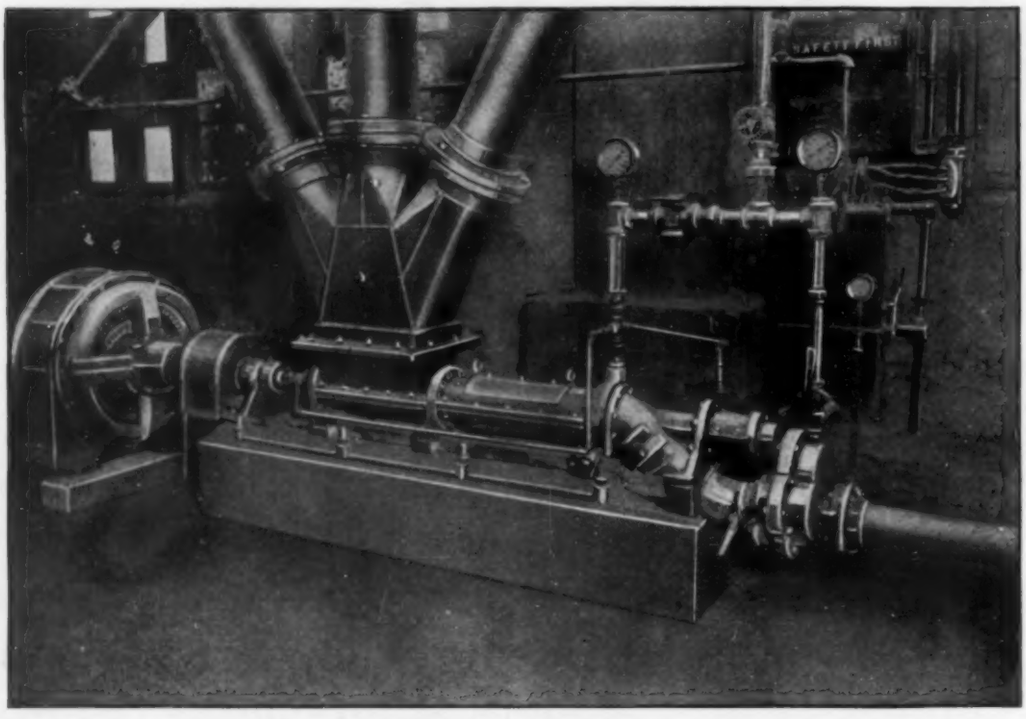
Here are two totally different manufacturers who had the same problem, that of speed in handling boxes and cartons, of protection from damage and of lowering handling costs. They eliminated an uphill job and made easy coasting of it.

You may have up-hill handling problems. Put them up to our Engineers. They may have the solution to greater economy for you.

STANDARD
CONVEYOR COMPANY
NORTH ST. PAUL, MINNESOTA

New York, 405 Lexington Avenue
Chicago, 549 West Washington Street
Philadelphia, 3110 Market Street
Cleveland Office, 829 Hippodrome Building
Indianapolis Office, 601 State Life Building
Kansas City, 419 Manufacturers' Exchange Building
Milwaukee Office, 209 W. Wisconsin Ave.
Los Angeles, 335 South San Pedro Street
Seattle Office, 321 Lumber Exchange Bldg.
Charlotte Office, P. O. Box No. 131.

No Dust Losses In Conveying Bauxite Or Any Bulk Material



Fuller-Kinyon Pump handling Caustic Lime in a large Middle Western Plant

CLEAN, dustless conveying of all pulverized materials such as bauxite, zinc, oxide, cement, phosphate rock, calcium arsenate, gypsum, pigments and the like, can be obtained at a low operating and maintenance cost by the installation of the

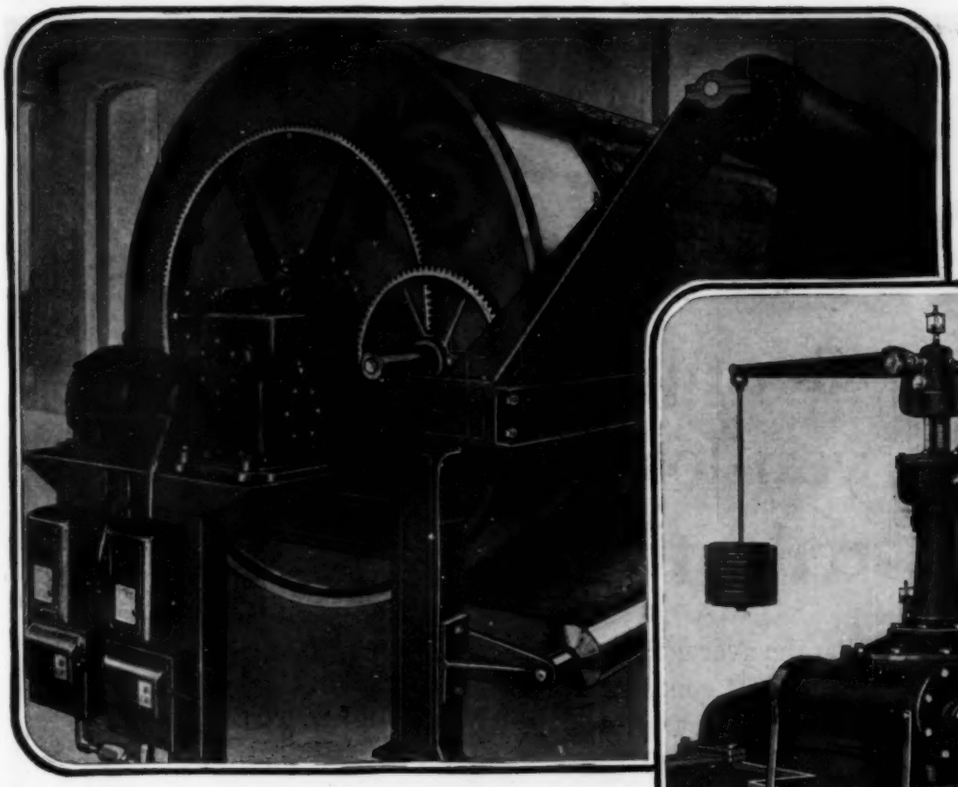
FULLER-KINYON
Conveying System

The system consists essentially of a Fuller-Kinyon pump which is the motive force to push the material through a pipe line, a source of compressed air supply for aerating the material and a system of distributing valves which may be controlled automatically, or by push buttons to divert the flow into various bins, by one operator under the guidance of an electric lighted bin indicating panel.

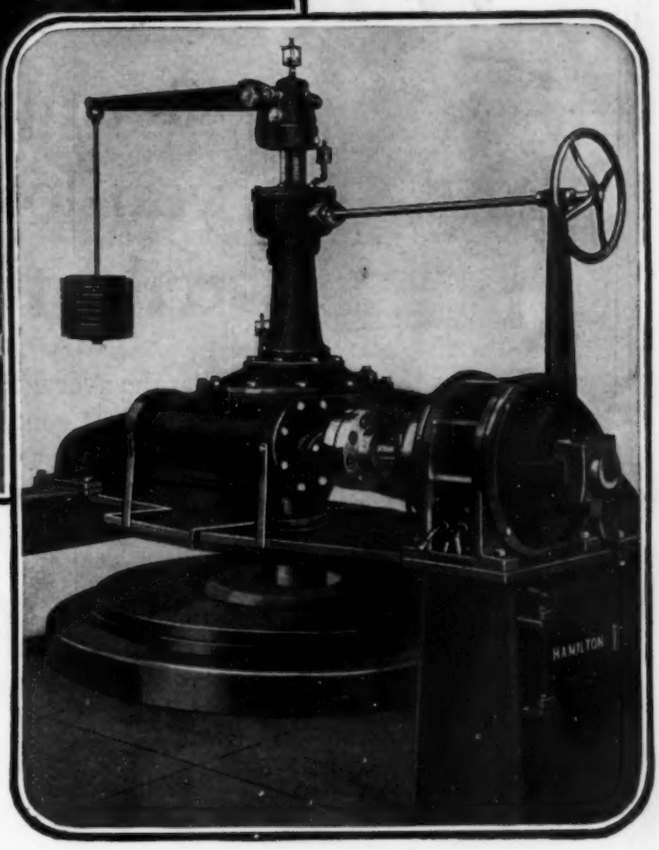
The flexibility of the system is complete. It may be adapted to meet all requirements of the kind of materials to be handled, and the direction of flow, irrespective of existing equipment layouts. The system is safe from fire, explosion or mechanical hazards. The power consumption and the wear are very small.

Our engineering department is available for consultation, regarding the solution of your materials conveying problems.

FULLER COMPANY, Catasauqua, Penna.



Above: Standard Cleveland Worm Gear Reduction Unit built into the drive of a carpet steaming and drying machine. Ratio 8⅝:1, 5 hp., 1,200 r.p.m.



Below: Standard Cleveland Worms and Gears are furnished in this grinder head for a plate glass finishing machine. Ratio 33⅓:1, 20 hp., 865 r.p.m. Each machine is equipped with twenty-five of these heads.

Cleveland Worm Gear Drives for Your Special Machines

Cleveland
CW&GC
WORM GEAR
REDUCTION UNITS

The standard Cleveland Worm Gear Reduction Units are described in Bulletin No. 106. *Send for your copy.*

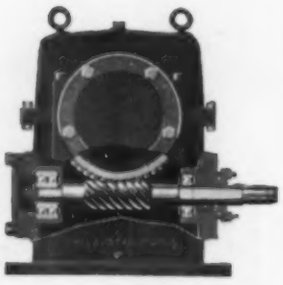
A dependable drive is a major requirement for special production machinery. The Cleveland worm gear drive eliminates production delays and reduces maintenance attention and cost to an absolute minimum. Standard Cleveland worm gearing can be built into the housing of the machine or a standard enclosed reduction unit can be incorporated in the design. Both arrangements are illustrated above. It will pay you to consider the Cleveland worm gear drive for your next special equipment.

"Cleveland Worm Gearing—the Ultimate Drive"

CLEVELAND
WORM & GEAR COMPANY

3251 EAST 80th STREET CLEVELAND, OHIO

what %



of applied power do you lose through speed reduction?

IT has been estimated that the average open gear train reduction device consumes about 25% of the power generated by the prime mover,—and aside from this "high power loss," the open gear train is hard to lubricate, on account of being exposed to dirt, moisture, grit, etc. This results in excessive wear, which produces vibration and pounding,—with resultant short life.

PHILLIE GEAR

Speed Reducers are the ideal drive for:

- Rotary Kilns
- Screw Conveyors
- Agitators
- Ball Mill Feeders
- Hydrators
- Rotary Dryers
- Bag Cleaners
- Slurry Tanks
- Grizzlies
- Crushers
- Feeder Loaders
- Mechanical Stokers
- Elevators

Philadelphia SPEED REDUCING UNITS

deliver a "high percentage of applied power," because every precaution has been taken to reduce friction to a minimum. Ball or Roller Bearings (or both) as the service requires, are used on shafts,—while all moving parts operate in an "oil bath." Another advantage: All gears used in Philadelphia Units have "perfect tooth contact" and are made of the highest grade metals obtainable, properly treated for resistance to wear.

Available in Spur, Worm, and Herringbone Gear Types; any ratio,—in horsepowers up to 200. Straight Line, Right Angle or Vertical Drive.

The result of nearly 50 years' GEAR MAKING experience.

Main Office and Plant Erie Ave. and G St. Phila., Pa.

PHILADELPHIA GEAR WORKS

Manufacturers of Industrial Gears and Speed Reducing Units

PHILADELPHIA, PENNA.

Branch Sales and Engineering Office: 12 E. 41st St., New York

"This Book shows us the solution of one of our Problems — -Lower Cost Conveyor Operation and Maintenance" says the Production Manager

6 Advantages

- Greater Strength
- Less Weight
- Easy Assembly
- No Loose Pins
- Resistance To Abrasive Wear
- Better Bearing on Sprockets

Men responsible for conveyor operation and maintenance have found that this drop forged chain enables them to cut costs materially. Wherever material handling by the chain conveyor method is profitable, there is an additional saving possible by equipping with Morco chains.

The six advantages of the patented **MORCO DROP FORGED CONVEYOR CHAIN** are described in this FREE book

MOORE DROP FORGING CO.
Springfield, Mass., U.S.A.
Detroit Office:
4-255 General Motors Building

MOORE DROP FORGING CO.
Springfield, Mass.

Please send me a copy of the new book on MORCO DROP FORGED CONVEYOR CHAINS.

Name .....
Position .....
Company .....
City .....
State .....

—An eel Couldn't Slip on BLAW-KNOX SECURITY STEEL GRATING & FLOORING

—much less a pedestrian. Note the twisted cross bars which are slightly raised above the bearing bars. Their roughened edges present a traction surface unequaled by any other form of grating.

Note, too, that BLAW-KNOX Security Grating is truly one-piece; not put together with bolts or rivets, not cut, slotted or punched, nothing to become loose and rattle.

The twisted bars are united with the bearing bars at intersections by ELECTROFORGING under enormous pressure.

Because of its design and method of fabrication, BLAW-KNOX Security Grating and Flooring can be perfectly galvanized and painted. There are no crevices left unprotected to invite corrosive action.

Note the clean-cut rectangular openings which assure maximum light and ventilation, also cleanliness because there are no acute angles to collect debris.

BLAW-KNOX Security Grating and Flooring is used for:

Stairways, steps and landings
Runways of all sizes and descriptions
Flooring in power houses and other industrial buildings, floors of ships, etc.
Ventilating Shafts and Hatchways
Fire Escapes and for Miscellaneous Industrial Uses.

Catalog on request.
Attractive territories are still open for high class distributors.

BLAW-KNOX COMPANY
690 Farmers Bank Building, Pittsburgh, Pa.
Branches in all principal cities
Export Division: Milliken Bros. — Blaw-Knox Corp.
342 Madison Ave., N. Y. City

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BLAW-KNOX

WRITE
for this NEW *Book*
ON
ENCLOSED WORM GEAR SPEED REDUCERS

You will find this new book on enclosed worm gear speed reduction drives a very useful and practical work. It not only contains information about the Jones Worm Gear Speed Reducer, but also contains much helpful data on the application of worm gear reducers to drives of various kinds. It is well illustrated with photographs and is printed in clear, easy-to-read type. Write for your copy today on your own letterhead, or use the coupon if you prefer. We will gladly send it to you.

W. A. JONES
FOUNDRY & MACHINE COMPANY
4416 West Roosevelt Road
Chicago, Illinois

W. A. JONES FOUNDRY & MACHINE CO.
4416 W. Roosevelt Road, Chicago, Illinois

Gentlemen: Please send me copy of the Worm Gear Speed Reducer Book.

Name ..... Company .....

Position ..... Address .....

City ..... State .....

Your Engineering Department Needs This Book

200 Pages of Engineering Information

200 Pages of 621 are devoted to mechanical engineering information, carefully selected, classified and indexed for easy and instant reference. You will find this book invaluable in figuring and selecting Gears and Reduction Units of all types to meet all requirements and estimating costs.

What Others Say:

"Great assistance to our Engineering Department" *John Deere, Harvester Works*
"Unusually Complete" *Pittsburgh Plate Glass Company*
"Very valuable reference book for our Drafting Division" *Sears, Roebuck & Company*
"Used as a textbook in our Engineering Department" *Matthews Conveyor Company*
"Great deal of help to us" *American Can Company*
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"You are to be congratulated on so complete a work" *Joseph T. Ryerson & Sons, Inc.*
"The most comprehensive and elaborate treatise in the Gear Field" *International Smelting Company*

FREE only to Executives and Engineers

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FOOTE BROS. GEAR & MACHINE CO.
231-241 N. Curtis St., Chicago, Ill.

Please send without obligation a copy of Gear Problems and IXL Speed Reducers.

Name .....

Address .....

FOOTE BROS. GEAR & MACHINE CO.
CHICAGO
231-241 North Curtis Street

Sales Offices in All Principal Cities U. S. A. and Canada

"They Keep a -Running"

10 Horse Power Century Type SC Squirrel Cage Induction 3 and 2 Phase Motor

Continuity of Service

The long, uninterrupted service which users of Century Type SC Squirrel Cage Induction 3 and 2 Phase Motors experience, results from liberal proportions, with proper mechanical and electrical design, and correct allocation of active materials.

Additional desirable features which contribute to their "Keep a-Running" ability are:

1. Armatures are practically indestructible. The copper bars and end rings are brazed over an area approximately six times their cross section.
2. Bearings last under severe service. They are made from cast phosphor bronze, machined to micrometer limits—and provided with machine-cut figure-8 oil grooves.
3. Field coils withstand the dampness of humid, tropical climates because they are insulated with moisture-resisting material and the completed winding saturated with insulating compound.

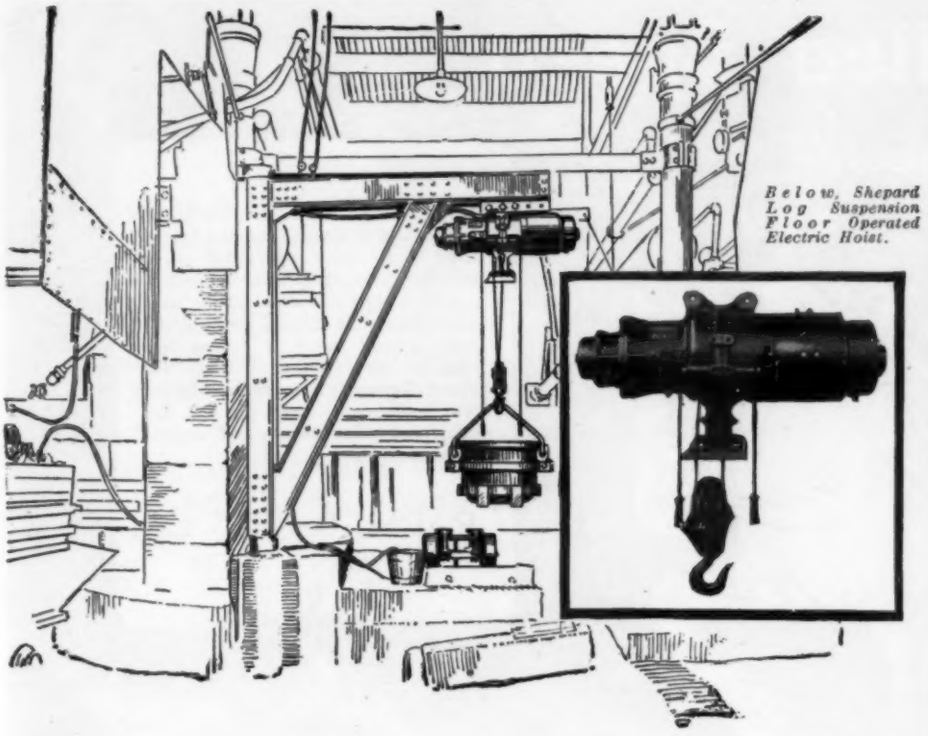
Century Type SC Squirrel Cage Induction 3 and 2 Phase Motors are built in all standard sizes from ¼ to 75 horse power. Under normal conditions temperature rise is not more than 40 degrees Centigrade.

33 Stock Points in the United States and More Than 50 Outside Thereof

CENTURY ELECTRIC COMPANY
1806 Pine St. St. Louis, Mo.

For More Than 23 Years at St. Louis

¼ to 75 H. P. Century MOTORS ¼ to 75 H. P.



Below, Shepard Log Suspension Floor Operated Electric Hoist.

"Uninterrupted service— 30 tons of molten lead daily"

Such is the service of the floor operated Shepard Hoist at the American Smelting and Refining Co., Leadville, Col.

Exposed daily to direct radiation from 30 tons of molten lead, to fumes and dust, the hoist has given "uninterrupted service."

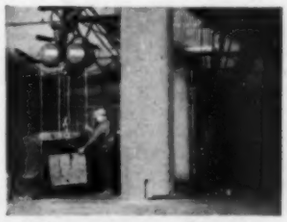
Not alone does Shepard give you enclosed unit construction, balanced drive and automatic oil bath lubrication. Shepard provides a precision control that means absolute safety in handling dangerous loads and delicate lifts.

Shepard renders a complete "uninterrupted service" to industry, by building a comprehensive, performance-proved line of electric hoists and cranes—a load handling service that is adaptable to the specific requirements of any industry.

SHEPARD ELECTRIC CRANE & HOIST CO.
382 Schuyler Ave., Montour Falls, N. Y.
Branches in Principal Cities
Largest Manufacturer of Electric Hoists in America

SHEPARD
ELECTRIC CRANES & HOISTS

Shepard Serves Industry With:



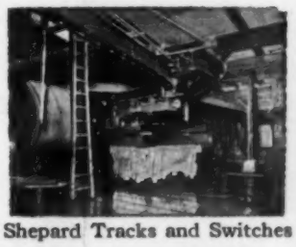
Floor Operated Hoists

Cage Operated Hoists

I-Beam, Jib and Bracket Cranes

Transfer Cranes

Traveling Cranes



Shepard Tracks and Switches

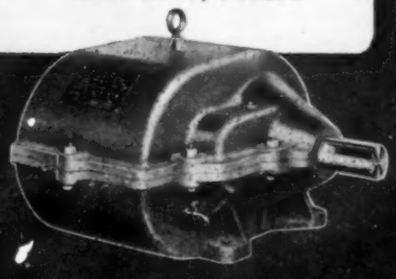
Winches

Controlled Speed

is "horsepower saved"

STEPPING down the r.p.m. of standard electric motors to the most satisfactory operating speed for the driven machine—maintaining that same consistent speed hour after hour, day in and day out the year around—*with a power loss that is insignificant,* Palmer-Bee Speed Reducers earn their original cost many times over through the numerous advantages and economies effected.

PALMER-BEE CO.
DETROIT, MICH.

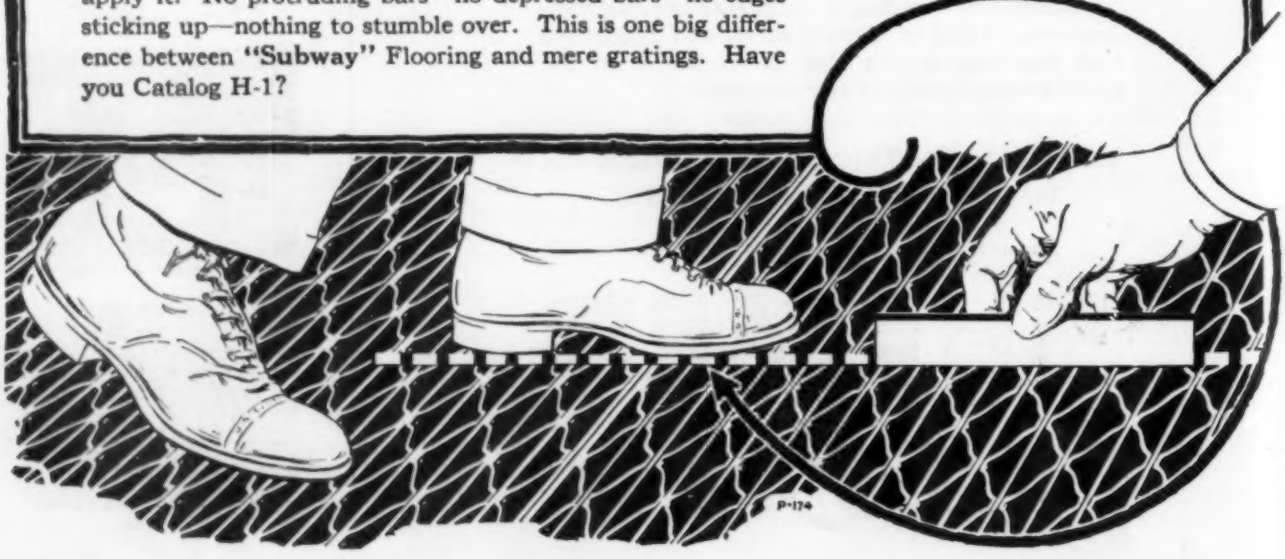


OPEN STEEL
IRVING
SUBWAY
FLOORING

"Subway" is the only steel flooring of grating type in which **every** bar does its share in carrying the load and giving good traction for foot or wheel—**always** smooth, but **never** slippery.

Lay a straight-edge on a panel of **"Irving Subway."** See how it touches **every** bar, no matter in what direction you apply it. No protruding bars—no depressed bars—no edges sticking up—nothing to stumble over. This is one big difference between **"Subway"** Flooring and mere gratings. Have you Catalog H-1?

IRVING IRON WORKS CO.
LONG ISLAND CITY, N.Y. U.S.A.
Established in 1902
SALES OFFICES IN ALL PRINCIPAL CITIES
See Your Telephone Book for Local Address



Permanent Alignment

The alignment problem disappears when pulleys are mounted on Timken Bearings. They permit utmost precision in the original assembly and they maintain it despite the heaviest belt-lash. For Timkens fully withstand thrust and shock as well as greater radial load.

Protection against all elements of wear, friction included, results from Timken tapered construction, Timken *POSITIVELY ALIGNED ROLLS*, and Timken-made electric steel. Under all conditions there is entirely self-contained rolling motion in simple, compact, drip-proof mountings. Maximum savings of power and lubricant are certain.

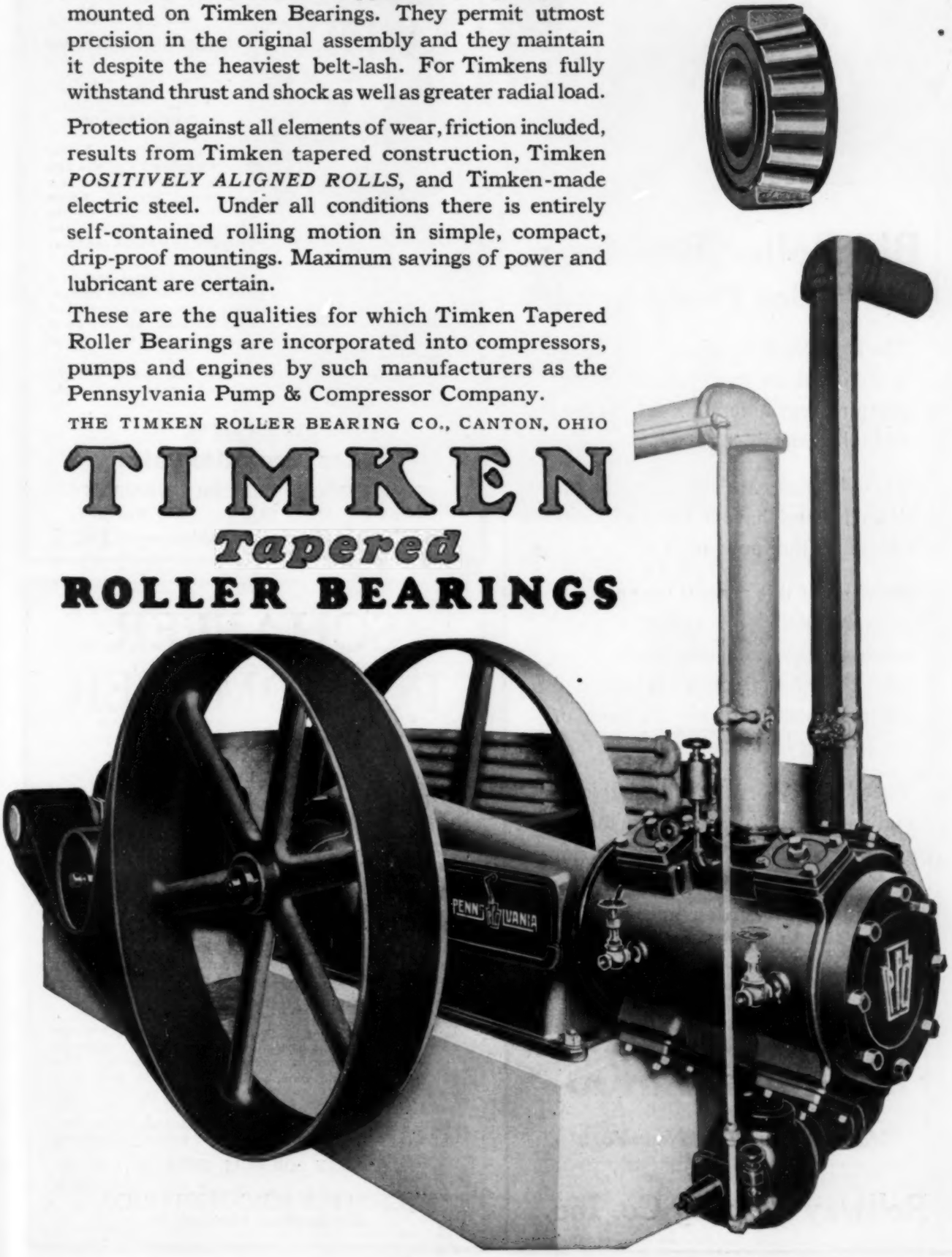
These are the qualities for which Timken Tapered Roller Bearings are incorporated into compressors, pumps and engines by such manufacturers as the Pennsylvania Pump & Compressor Company.

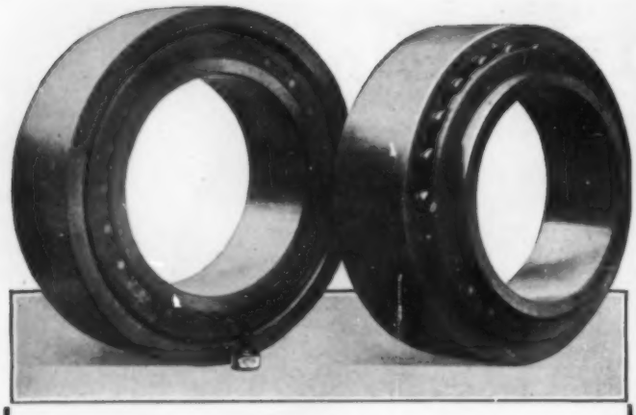
THE TIMKEN ROLLER BEARING CO., CANTON, OHIO

TIMKEN

Tapered

ROLLER BEARINGS





Big Roller Bearings for Million Pound Loads

The Roll Neck Bearing shown above is designed to carry the enormous pressures encountered in rolling steel and other metals.

These bearings are nearly two feet in diameter and have a rated capacity of one million pounds.

Bearings of this general type are also recommended for calender rolls, crushing rolls, and other applications where the shaft diameter is large and the permissible outside diameter of the bearing is limited.

The Rollway organization has specialized for eighteen years in heavy duty bearings for heavy industrial service. We solicit an opportunity to study your hardest and heaviest bearing problem.

ROLLWAY CYLINDRICAL ROLLER BEARINGS

Made in Syracuse, New York by

Rollway Bearing Co. Inc.

Make this distinction:

Silica and graphite mixtures *vs* a natural combination

Since Dixon's Silica-Graphite Paint was first made, 60 odd years ago, many graphite paints have appeared on the market. None but Dixon's, however, is made with the famous *Ticonderoga Flake Graphite in natural combination with silica.*

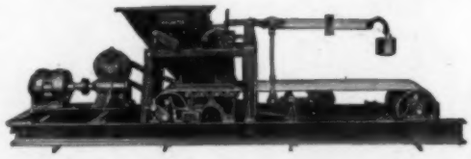
We say without hesitation that this pigment makes a more durable and efficient paint. And we know because we use in our various products every known grade of graphite. We have tested many formulas, and we have evidence in many remarkable service records made by the original product.

You can not do better than to use and specify Dixon's Silica-Graphite Paint for all exposed metal or wood work. Write for Booklet 243-B.

DIXON'S
Silica-Graphite Paint

JOSEPH DIXON CRUCIBLE COMPANY
Jersey City New Jersey
1827 *One Hundredth Anniversary* 1927

SCHAFFER POIDOMETER



ALMOST HUMAN

Schaffer Poidometers are the mechanical brains of the plant. They are more than that—they are guardians of the quality standards you have set for your product—they prevent waste and assure accuracy and maximum economy.

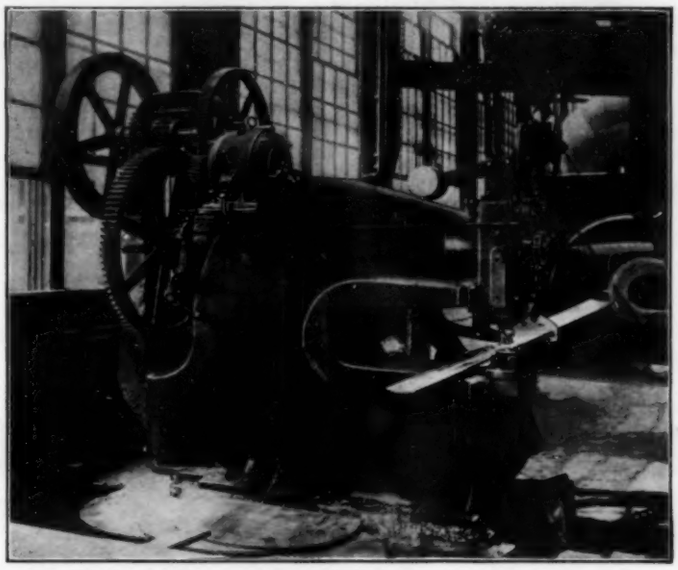
If you are handling a variety of materials, arrange your Poidometers in batteries—set one for each material and for the proportion wanted—then forget it! The Poidometer will do your bidding better than your most loyal employee. If any machine is not getting its full quota of material, the entire battery will automatically stop. Space does not permit of a thorough explanation of the many cost-saving qualities of Schaffer Poidometers.

WRITE FOR FULL DETAILS

SCHAFFER POIDOMETER CO.
2828 Smallman, Pittsburgh, Pa.

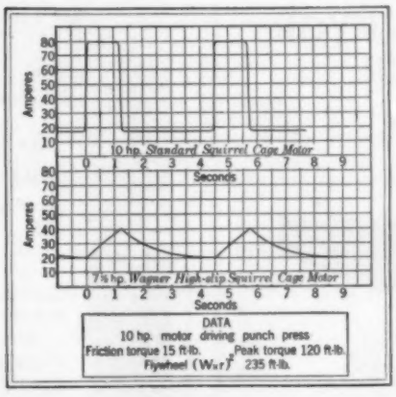
APPLICATIONS

This is one of a series of advertisements describing the proper application of alternating current motor types. Complete series will gladly be sent upon request.



Let the Flywheel do its work

THE flywheel on a motor-driven punch stores energy as the machine idles and delivers energy when the machine punches. In order to do this the flywheel must increase in speed as the machine idles and must slow down during the punching operation. The proper motor for this service is one that slows down under overloads. Such a motor possesses the inherent features of high slip and high starting torque. The Wagner High-Slip Squirrel-cage Motor allows the flywheel to do the work of punching, reduces the required power peaks and results in a more even demand for power. The motor is, therefore, not subjected to heavy shock.



A standard squirrel-cage motor, however, will not slow down enough to let the flywheel carry the load of punching and thus the motor creates a high power peak every time the punch operates. Furthermore, the press must be heavily over-motored in order to start the heavy flywheel. The curves (left) show the power required by a punch, first with a Wagner Standard Squirrel-cage Motor and next with the Wagner High-slip Squirrel-cage Motor for punch press applications. Note that this 7½-hp. Wagner High-slip Motor will do the work of a 10-hp. standard squirrel-cage motor and with much less line disturbance.

WAGNER QUALITY ALTERNATING CURRENT MOTORS

Wagner builds them all

Literature upon request

APPLICATIONS OF HIGH-SLIP HIGH TORQUE SQUIRREL-CAGE MOTORS

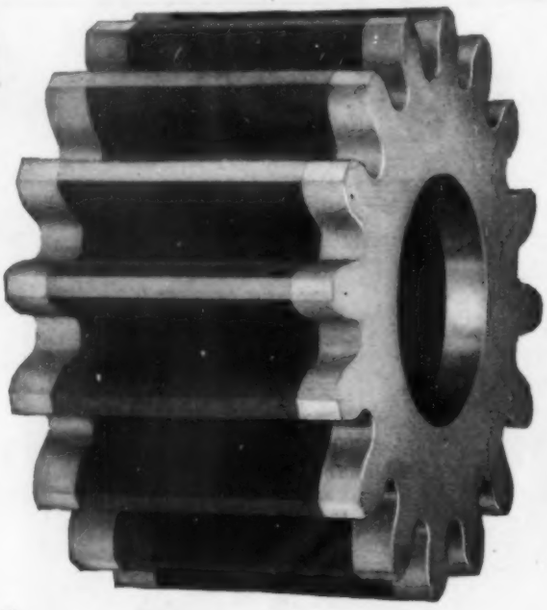
Punch Presses Small Rolls Shears

WAGNER ELECTRIC CORPORATION—6400 Plymouth Avenue—St. Louis, U. S. A.

Products: MOTORS—Single-phase, Polyphase and Fynn-Weichsel Motors. TRANSFORMERS—Power, Distribution and Instrument FANS—Desk, Wall and Ceiling types

61-7637-4

Fabroil Gears



Wear longer

We sincerely believe that Fabroil Pinions are the finest noiseless pinions obtainable. This statement. after thirty-five years of noiseless gear making embracing experience with fibre, paper, rawhide, and bakelite pinions should mean something to the user of non-metallic pinions.

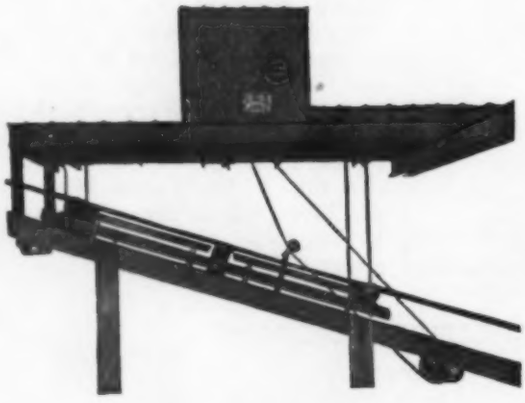
DRIVE IT WITH GEARS

The Horsburgh & Scott Co.

5000 Hamilton Ave. *"Gear makers since '89"* Cleveland, U. S. A.

Gears for Every Industrial Purpose—Worm—Bevel—Herringbone—Spur—Spiral—Hardened Heat Treated Gears—Non-Metallic Gears and Pinions

Weigh While You Convey over THE MERRICK CONVEYOR WEIGHTOMETER



Any material which is conveyor-handled can be weighed without additional handling or loss of time by the Merrick Conveyor Weightometer

An Automatic—Continuous—Accurate Record

MERRICK SCALE MFG. COMPANY
186 Autumn St., Passaic, N. J.

MITCO INTERLOCKED STEEL FLOOR GRATING

No Acute Angles In Mitco

INSTEAD, the openings of Mitco Interlocked Steel Floor Grating are rectangular—90% open area. Consequently, Mitco is entirely free from clogging and admits more light and provides better ventilation.

Mitco is the non-clogging, non-slipping steel floor grating of greater strength and rigidity that assures maximum light and ventilation.

Read more about Mitco advantages in the new booklet just printed. Write for a copy.

HENDRICK MFG. CO.
53 Dundaff St., Carbondale, Pa.
New York Office: 15 John St.
Phone: Cortlandt 2440
Pittsburgh Office: 904 Union Trust Bldg.
Makers of Hendrick Perforated Metal Screens

Enclose Your Screw Conveyor In Caldwell Steel Conveyor Boxes

Screw Conveyor Boxes may also be had in cast iron for conveying materials which rapidly corrode or rust out steel conveyor boxes.

STEEL Conveyor Boxes are an effectual means for the prevention of fire, and are sanitary. For these reasons many State governments are enforcing the replacement of wooden screw conveyor boxes with steel.

In addition to offering protection against fire they last infinitely longer.

Built in all standard sizes, you can get them promptly from Caldwell. Detailed information and prices upon request to our nearest office.

Caldwell Products

Power Transmission Machinery—Bearings, Shafting, Pulleys, Machine Molded Gears, Cut Gears, Hangers, Chains and Wheels.

Elevating and Conveying Machinery—Helicoid Conveyor and Accessories. Belt Conveyors, Chain Conveyors, Elevator Buckets, Boots and Casings, Car Spotters, etc.

H. W. CALDWELL & SON CO. C-80

LINK-BELT COMPANY, OWNER

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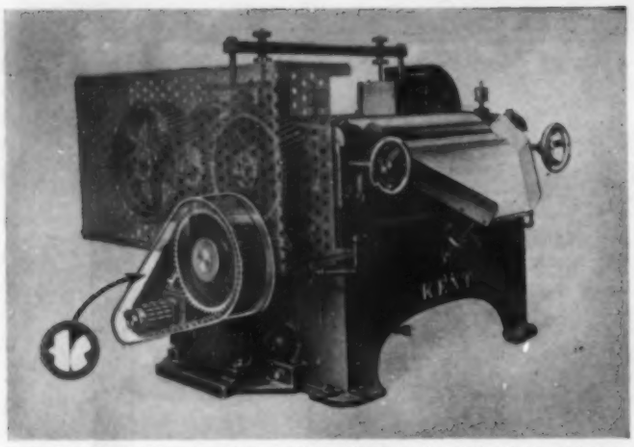
St. Louis.....3638 Olive Street
Seattle.....820 First Ave. S.
Toronto (2), Canada, Wellington & Peter Sts.
Wilkes-Barre...826 Second National Bank Bldg.

CALDWELL



Roller Ink Mill driven by Morse Silent Chain, enclosed in dirt-proof case.

An integral part of the machine

Many manufacturers are equipping their machinery with Morse Silent Chain Drives as integral parts of the machines. They realize that the reliable operation of Morse Chains helps to maintain the quality of their products.

You will be interested in the improved type No. 55 Morse Chain that insures even greater years of dependable service. A Morse Transmission Engineer will gladly give you the complete details and can offer experienced help in solving your power transmission problems. Just address the nearest office below.

MORSE CHAIN CO., ITHACA, N. Y., U.S.A.

ATLANTA, GA., 702 Candler Bldg., Earl F. Scott & Co.
BALTIMORE, MD., 1002 Lexington Bldg.
BIRMINGHAM, ALA., Moore-Handley Hardware Co.
BOSTON, MASS., 141 Milk St.
BUFFALO, N. Y., Ellicott Square Bldg.
CHARLOTTE, N. C., 404 Commercial Bank Bldg.
CHICAGO, ILL., 112 W. Adams St.
CLEVELAND, OHIO, 421 Engineers Bldg.
DENVER, COLO., 211 Ideal Bldg.
DETROIT, MICH., 7601 Central Ave.
LOUISVILLE, KY., 516 W. Main St., E. D. Morton Co.
MINNEAPOLIS, MINN., 413 Third St., Strong-Scott Mfg. Co.
NEW ORLEANS, LA., Queen and Crescent Bldg., 334 Camp St., A. M. Lockett & Co., Ltd.
NEW YORK, N. Y., 50 Church St.
PHILADELPHIA, PA., 20 South 15th St.
OMAHA, NEB., 923 W. O. W. Bldg., D. H. Braymer Equipt. Co.
PITTSBURGH, PA., Westinghouse Bldg.
SAN FRANCISCO, CALIF., Monadnock Bldg.
ST. LOUIS, MO., 2133 Railway Exchange Building.
TORONTO, 2, ONT. CAN., 50 Front St. E., Strong-Scott Mfg. Co.
WINNIPEG, MAN., CAN., Dufferin St., Strong-Scott Mfg. Co.

2232

MORSE SILENT CHAIN DRIVES

Well Water Supply At Low Cost

Shallow sand strata can be developed to give a permanent, dependable water supply for your factory or plant, by

Air Made Wells and Sullivan Air Lift

At Greensburg, Kansas, for example, before Air Made Wells were installed, four drilled wells had gone dry, and a huge dug well 32 ft. in diameter and 96 ft. deep, had fallen off to 90 g.p.m. Now from two 8-inch Air Made Wells, Greensburg has available 450 g.p.m.

Sullivan Air Lift delivers the water to the mains for less than three cents per 1000 gallons including power, depreciation, and attendance.

Write for Catalog 56-JCM.

Sullivan Machinery Company
Adams and Michigan, Chicago

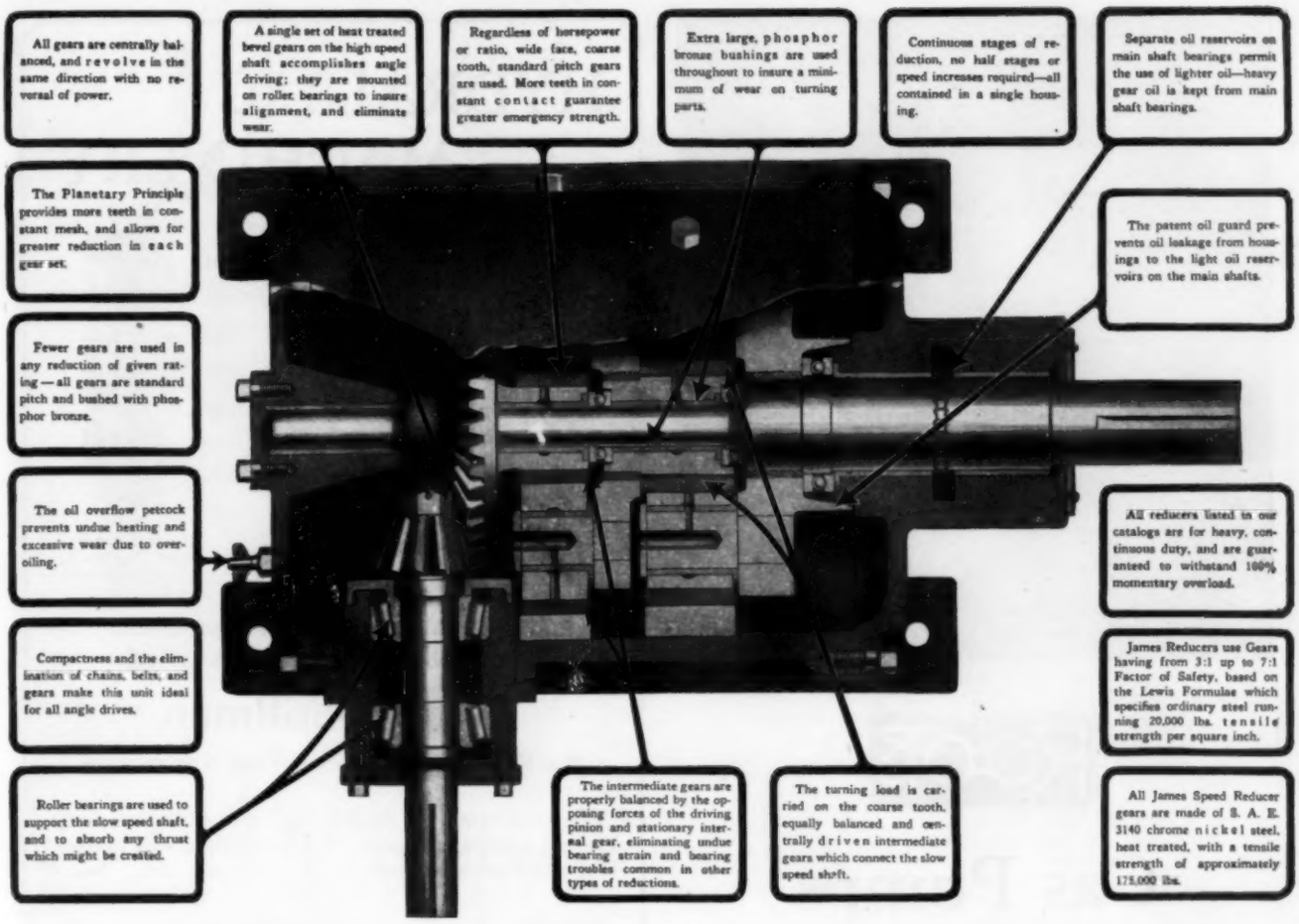
SULLIVAN

De Laval Worm Gears

Superior Speed Reducers

Each 25 HP. 800 R.P.M. motor drives stock chests thru two 7½ ratio gears and five De Laval Flexible Couplings

De Laval Steam Turbine Co.,
Trenton, New Jersey



The James Planetary Angle Drive Spur Gear Speed Reducer

The spur gear speed reducer was originated, designed—improved, simplified—and standardized by the D. O. James Manufacturing Company, established in 1888. We have specialized in the making of cut gears and speed reducers for more than twenty-five years. Since that time when we were the only speed reducer manufacturer, we have constantly improved, designed and developed new types, until today we are producing from 600 to 700 standardized reducers every month.

There are over 35,000 James Reducers used by industry today on drives of every nature—many of them having given 10, 15, even 20 years of uninterrupted service without repair or maintenance.

The major reasons for the supremacy of James Reducers on drives of every kind are most graphically shown in the illustration above. These features, exclusively James, are the result of long years and tireless effort on the part of our engineering organization, and the proof of their superiority is complete acceptance as standard throughout the engineering fraternity.

James Planetary Angle Reducers are made for driving elevators, conveyors, screens, feeders and process machinery where space is at a premium, as they can be installed under or directly alongside of the equipment they drive.

Note the size and material in the bushings on James Reducers. Compare them with ordinary reducers. Compare the shaft sizes for a unit of any given horsepower and ratio with other makes of speed reduction. Compare the principle—planetary—with any other principle—the size of gears, the width of gear faces, the gear material, the compactness of the unit—in fact, we invite comparison of any part or principle of the James Planetary Speed Reducer with any other reduction of similar horse-power and rating.

Let us give you complete information on the sizes of gears in each stage of reduction, or any other information you may desire, so that you may check them for design, durability and the factor of safety that is nbuilt.

The term "efficiency," as applied to speed reducers, means not only applied and delivered power, but low first cost and the guarantee of trouble-free operation—it is found in every James Reducer.

James Reducers are made in types to suit every requirement—herringbone, planetary spur gear and worm gear—to drive up, down, at an angle or in a straight line—for light, medium or heavy duty, and in all ratios and up to 1,000 H.P.

As the largest manufacturers of speed reducing transmissions, we invite your inspection of our facilities, and ask the opportunity of helping you to select the proper type of speed reducer for your work. Our engineering service is gratis.

D. O. JAMES MANUFACTURING CO., 1120 West Monroe Street, Chicago

D.O.JAMES

We are manufacturers of *Every Type* of speed reducer and cut gears

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Gas Pumps

There are dozens of places in chemical plants where Roots Exhausters are the *best* specification for the job.

Wherever there are still vapors to collect and reclaim, or gas of one sort or another to handle under pressures up to 10 lbs., Roots Gas Pumps will do the work economically, with little maintenance expense and, above all things, they do it *dependably*.

Roots units are seldom the cause of forced shut-downs for their simple, sturdy construction renders them capable of withstanding all but flagrant abuse.

Dependability is important—and for Dependability use

ROOTS GAS PUMPS
"Standard Since 1859"

The P.H.&F.M.ROOTS CO.
CHICAGO Peoples Gas Building
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Heating and Chilling Press for Rubber, Celluloid, etc.

Nearly 80 Years of constant research has developed the Watson - Stillman line. This long experience is your protection against experiment and untried design.

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If you have an operation on which Hydraulic Pressure Can Be Used

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Has the Equipment to Suit Your Requirement

We build complete hydraulic plants including pipe, valves, pumps, accumulators, intensifiers, and presses for every purpose such as:

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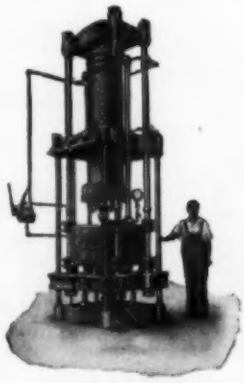
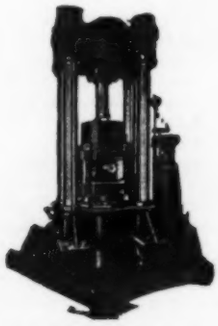
Cocoa Butter Extracting
Compressing and Forming
Etc.



Sagger Press



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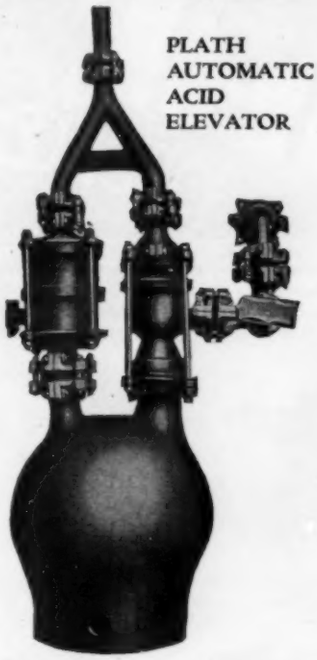
ELEVATOR



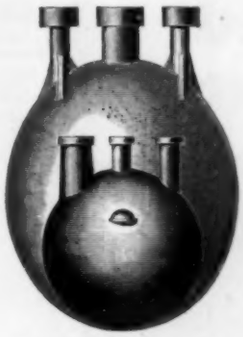


Fig. 369
VESSEL
without Base

Bulletin K is a condensed manual of acid elevator use and essential equipment. It should be in your possession with the other G-C bulletins for your advice and convenience in selecting chemical stoneware equipment.

Fig. 343
ACID ELEVATOR
with Dip-Pipe and Detachable Faucets

Only common sense prevails in G-C design

Large factor of safety!

Each vessel tested far above working pressure!

Absolute incorrodibility.

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Both hand operated and automatic types have given positive evidence of their practical design and construction.

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Acid Elevators
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Containers
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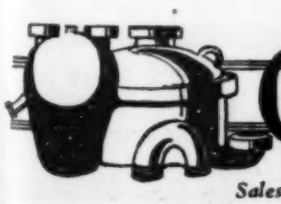

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In a Paint and Varnish Plant

One of the Blackmer Rotary Pumps at the Peaslee-Gaulbert Co. plant in Louisville, Ky.

The Peaslee-Gaulbert Co. has this to say:

"Since 1867 we have used many different types of pumps in handling heavy oils, paint, etc., and have found the Blackmer Rotary Pumps splendidly adapted to our needs in production of Pee Gee Paints, Lacquers, Varnishes and Enamels.

"These pumps show a fine suction lift, are large handlers, operate steadily and at very low upkeep cost, with the result that on new pumps and replacements we are specifying Blackmers."

The experience of this company is worthy of your consideration.

BLACKMER PUMP CO.
1809 Century Ave.,
Grand Rapids, Michigan
Offices in 20 principal cities

Your PUMP problem

PUT IT ON A TABER DATA SHEET

By requesting a Taber Data Sheet you secure definite, dependable, engineering recommendations on the correct pump for your needs- without obligation.

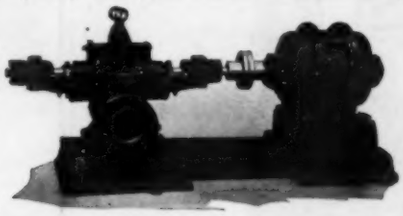
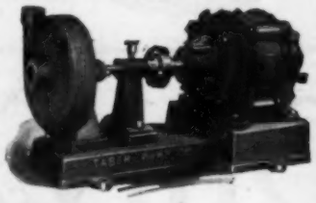


Fig. 510- Taber S L Double Suction Centrifugal Pump. Over a half century of pump building experience is built into every Taber Pump.

Fig. 172- Taber L- Single Suction Centrifugal Pump. All Taber Pumps are rugged- built for lasting efficient service.



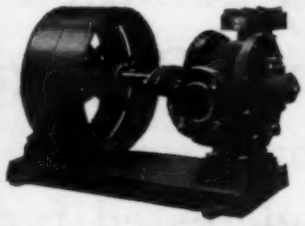
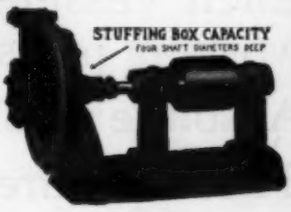


Fig. 301- Taber R- Rotary Pump. You deal direct with the manufacturer when when you seek information or buy Taber Pumps.

Fig. 192- Taber Single Suction Belt Pumps. Deep stuffing for chemical industry. Write for Bulletin L-627.



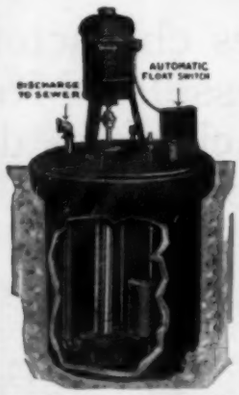


Fig. 194aB- Taber Vertical Sump Pumps for drainage and sewage.
Write for Bulletin 120-B.

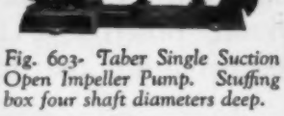


Fig. 603- Taber Single Suction Open Impeller Pump. Stuffing box four shaft diameters deep.

WRITE FOR THE TABER DATA SHEET. Sent in duplicate. One copy you retain- the other you return to us. No obligation.
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TABER
PUMP CO. *Est. 1859* BUFFALO, N. Y.

AMERICAN
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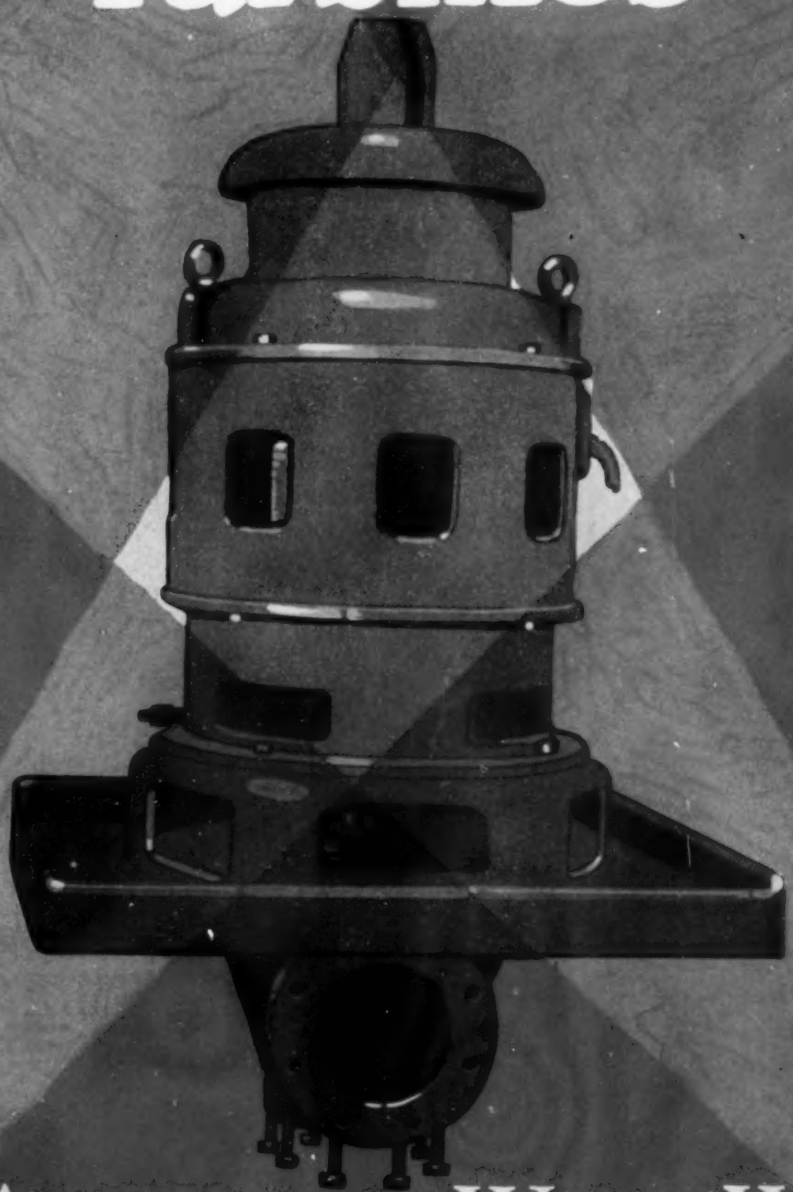
Deep Well Turbines



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AMERICAN
AURORA, ILL.

PICTURED on the opposite page is an "American Hollow Shaft Motor Deep Well Turbine Head. This is the "driving end" of the "American" deep well turbine, and is designed for use with hollow shaft motors. In this type of head the turbine line shaft extends up through the motor with a driving connection at the top. The pump's thrust load is carried by the top motor bearing, which is designed to carry this extra load. All adjustments are made at the top of the motor.

Due to its design, this Turbine Head has the great rigidity necessary to counteract any vibration from the moving parts in the line shaft and pump end of the turbine. The discharge is below the floor, as in other types of "American" Deep Well Turbine Heads.

Illustrated on this page is the "pump end" of the "American" large capacity non-diffuser turbine. This type of turbine permits an unusually large capacity with relation to the size of the well, and is suitable for use in bored wells from twelve inches and larger inside diameter.

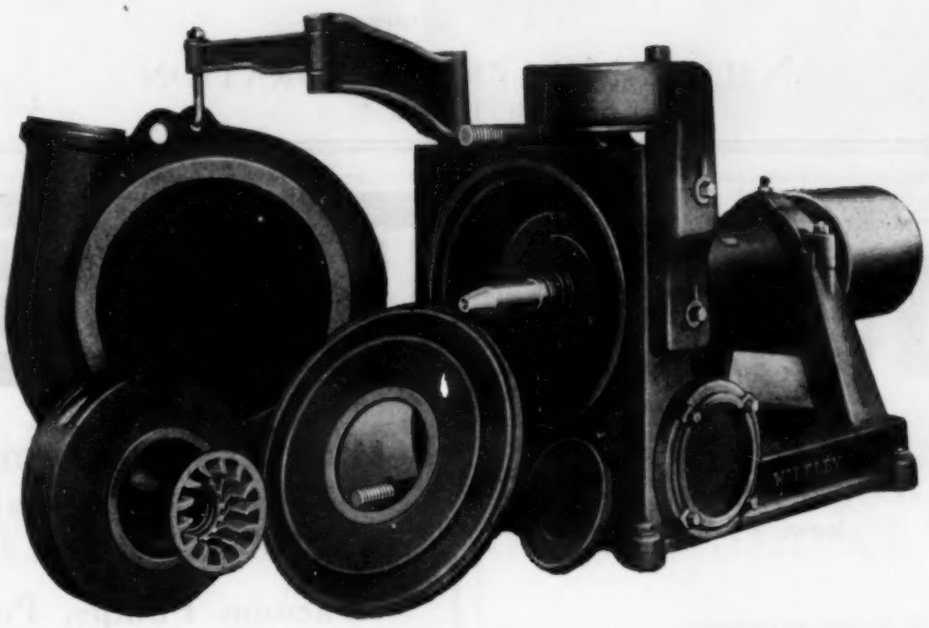
The turbine proper is a special type of vertical centrifugal pump and consists of one or more stages. Impellers are made of bronze and are carefully designed with blades accurately hand finished. They are in perfect rotative balance when mounted, with all moving parts on the shaft. Removable wearing rings are provided.

The turbine proper has two main bearings. The top bearing is separated from the water in the pump by a packing box and a leakage passage, which effectually prevents leakage from reaching the upper bearings. The design of this bearing prevents the entrance of any sand or gravel. The bottom or "tail bearing" is a patented feature of "American" Deep Well Turbines. Its design is of particular merit, as it dispenses entirely with lubrication by means of an oil line from the surface. This obviates the constant trouble of oil leaking into the turbine through oil pipe lines.

Special engineering bulletin on all types of "American" Deep Well Turbines is available. A copy will be forwarded to you on request.

THE AMERICAN WELL WORKS
AURORA **ILLINOIS**

WILFLEY



Pumping Cement Slurry

3" Wilfley Pump

Material: Cement Slurry at 35% moisture by weight Discharge of compeb to storage tanks.

Quantity: 100 barrels per hour.
Lift: 82 feet.

Discharge pipe: 550 feet of 5-in. pipe.

Pressure developed: 70 lbs.

THE PUMP WITHOUT A STUFFING BOX

WILFLEY Centrifugal PUMPS

PATENTED

FOR INDUSTRIAL GRITS

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Depreciation Whipped!

IF you use VINALOY pumps, valves, pipe and fittings, tanks, etc. Unaffected by nitric, acetic and sulphurous acids, mine waters, copper electrolyte, products of combustion.

Resists oxidation and abrasion. Strong at high temperatures.

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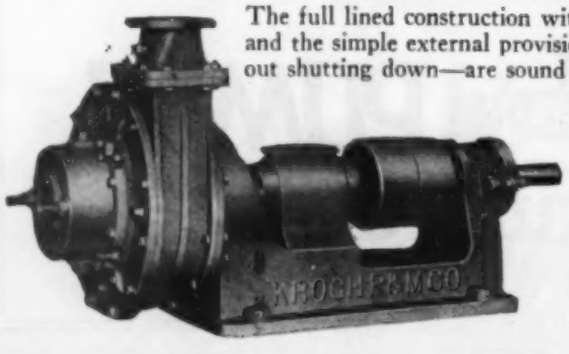
Kent Ave. and So. 10th St., Brooklyn, N.Y., U. S. A.

Low maintenance—a big feature



The full lined construction with the main bearing out of contact with the gritty fluids and the simple external provision for taking up wear at both sides of the runner, without shutting down—are sound reasons why the

KROGH
Full Lined Sand and Tailings Pump

costs very little to maintain in service. All liners are quickly accessible and can be removed and replaced without breaking the suction connections. Built 2-in., 3-in. and 4-in. in rated capacities from 75 to 600 g.p.m. Write for Bulletin No. 98.

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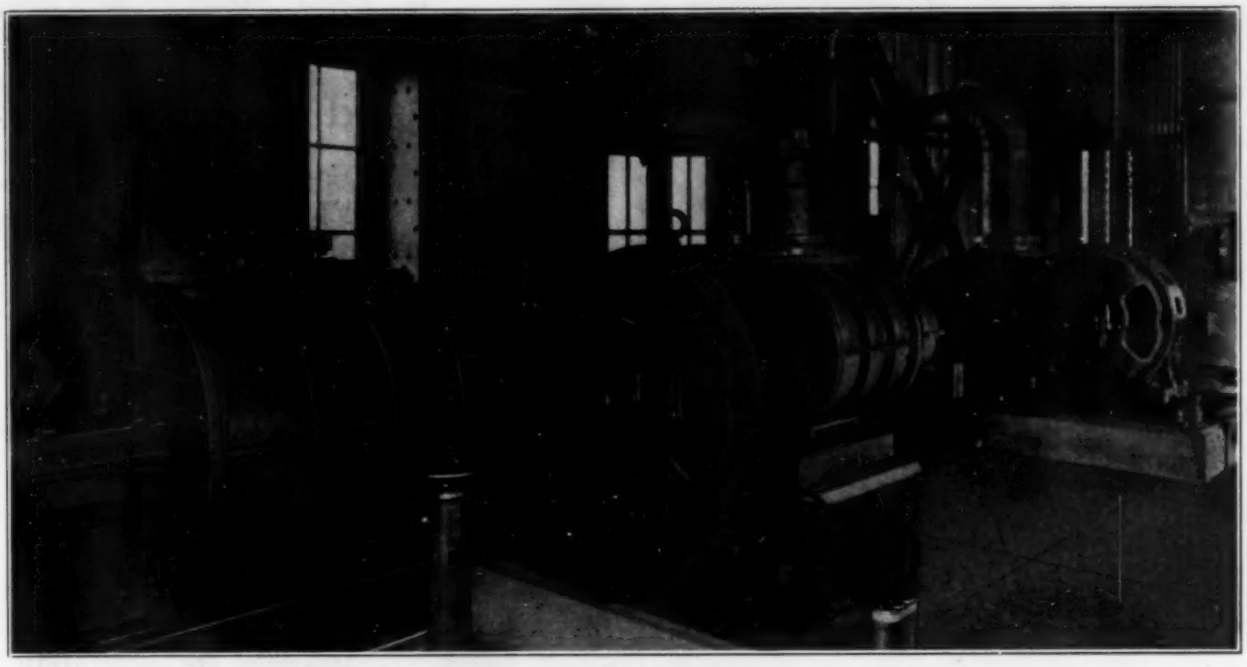

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Badger Flangeless Self-Equalizing Expansion Joints eliminate flanged connections in welded underground mains. They are made with open steel or wrought iron pipe ends that weld right into the line.

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The successful performance, without maintenance expense of **Badger Self-Equalizing Expansion Joints** installed by leading district heating companies makes them a safe selection for your lines.

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Representatives in all principal cities.

Iron Body Gate Valves —designed for strength

Fig. 325
Screwed, Jenkins Standard Iron Body Gate Valve

Fig. 651
Flanged, Jenkins Standard Iron Body Gate Valve with Bronze Spindle

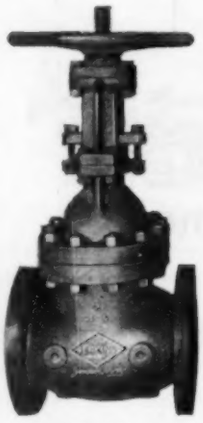

Fig. 204
Flanged Jenkins Extra Heavy Iron Body Gate Valve

Jenkins Iron Body Gate Valves have globe-shaped body with round-oval neck. This shape, based on the familiar fact that pressure containers possess maximum strength when made in shapes of a circular nature, provides a body possessing great strength as well as pleasing appearance.

Wedges are accurately machined and interchangeable, and wedge guides consist of two ribs of equal width, thus permitting reversal of wedge, insuring tight closing under all conditions.

The handwheel, patterned after the steering wheel of a motor car, provides firm grip and easy operation.

In addition to these features there are a number of other refinements that assure valves which will stand the severest service in the use for which they are recommended.

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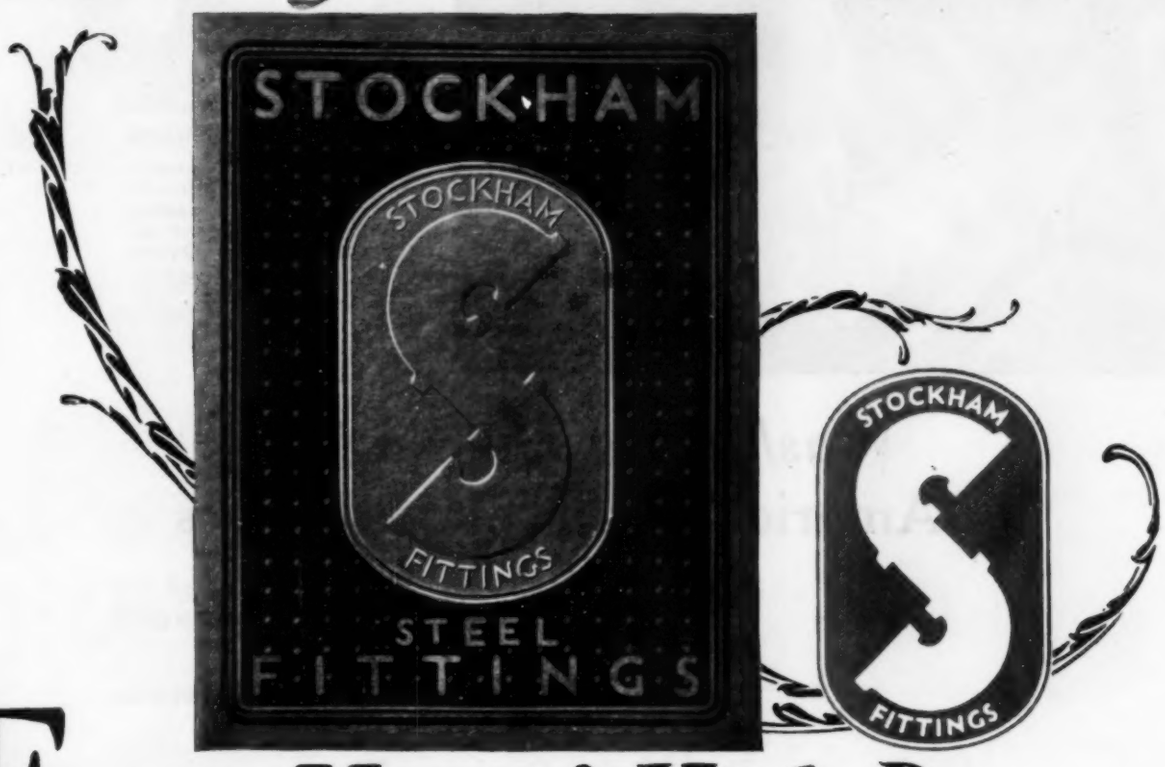

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A complete reference book, containing not only a detailed description of Stockham Flanged Steel Fittings and Flanges, but tables of temperature and pressure ratings, tables of dimensions—everything you need in figuring steel fitting requirements.

Stockham Flanged Steel Fittings and Flanges are manufactured from electric steel; they are made for working steam pressures of 150, 300, 400, 600, 900 and 1350 pounds, and are produced in accordance with the new American Standards; they actually exceed both chemically and physically the specifications of the American Society for Testing Materials. They possess the same inherent quality which has made reputation for Stockham Cast Iron and Malleable Fittings for more than a quarter century.

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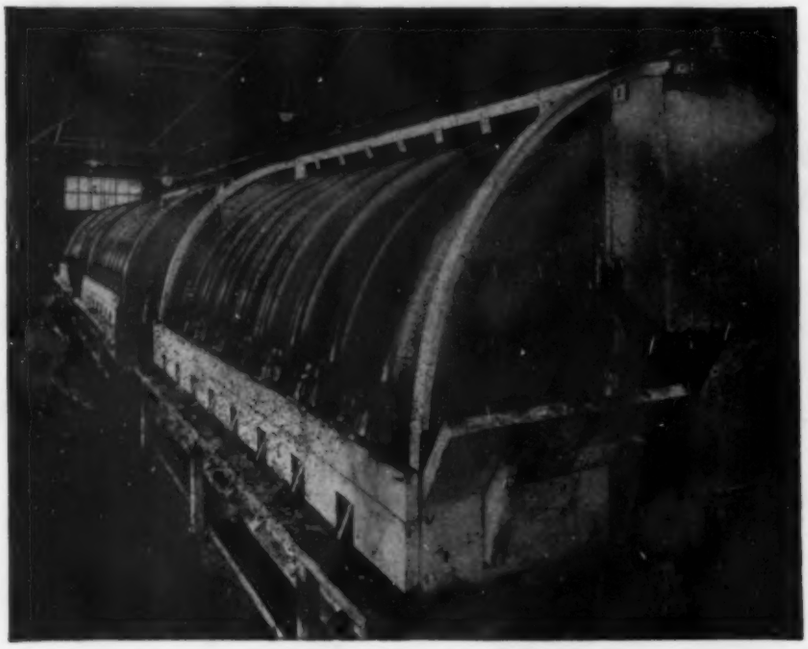

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Battery of American Continuous Filters filtering and washing slimes in one of the large Northern Ontario gold mills.

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On American Continuous Filters

WHERE could one find a better test of the washing efficiency of a filter than in a gold cyanide plant?

Washing of slimes must be 99% plus, otherwise gold is lost.

That American Continuous Filters are "thorough washers" is evidenced by the fact that in prominent gold districts— Northern Ontario for instance— they are definitely displacing other types of continuous vacuum filters.

Or take starch, from which all solubles must be washed clear.

Two Other Spraying Features

With American Filters, sprays are accessible and special design hoods confine the sprays to the filter.

It is certain that the largest starch factory would never install unit after unit of American Filters unless washing efficiency were of the highest order.

Widespread usage definitely establishes the thorough washing obtained on American Continuous Filters.

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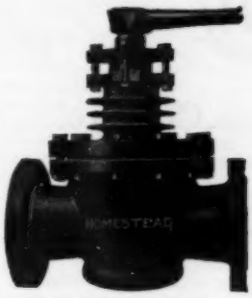

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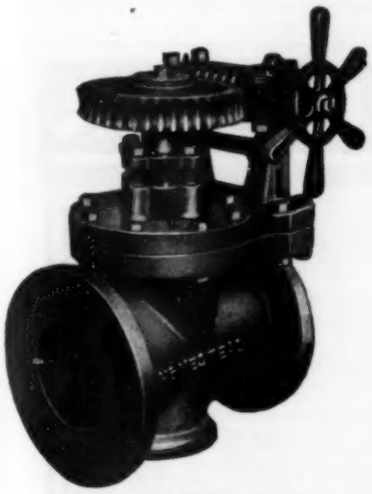

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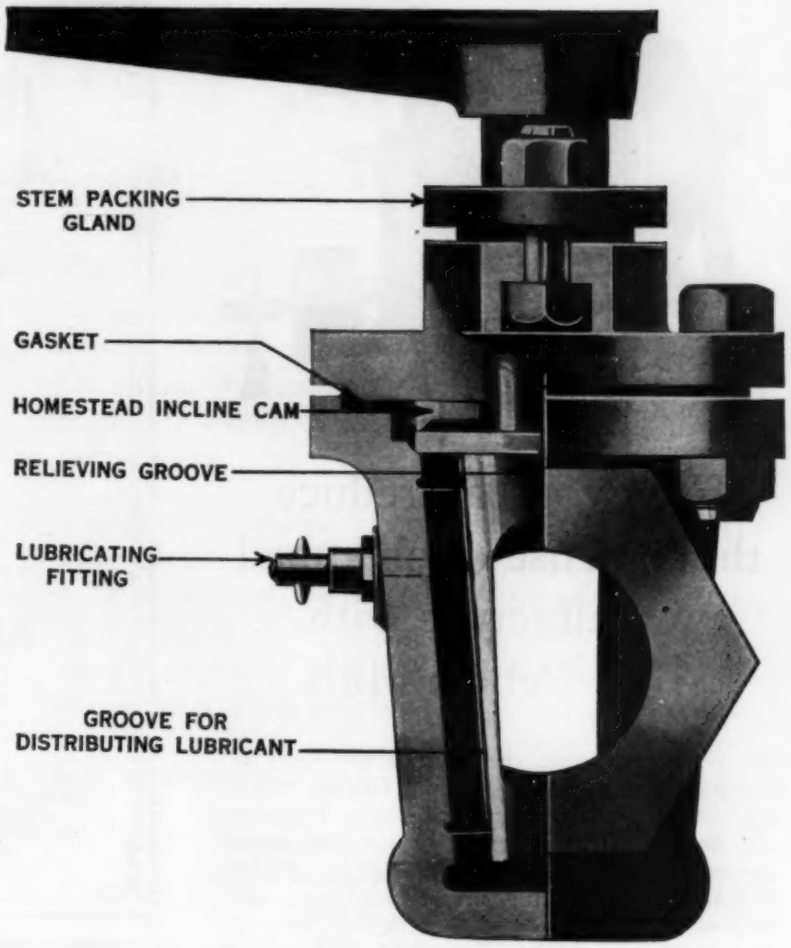
For large valves where ease of operation is a factor.



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ideal for the severe service of Process Industries

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Soap
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Gas Plants

This valve operates quickly and easily even though the operator forgets to lubricate.

Lubricant is an added protection to seating surfaces against action of corrosive fluids.

Homestead lubricants compounded to resist action of particular alkalies or acids being handled.

Lubricant injected under pressure is evenly distributed over seating surfaces with Alemite System.

They are equally suitable to high and low pressure steam, gas lines, and sulphate lines in paper mills.

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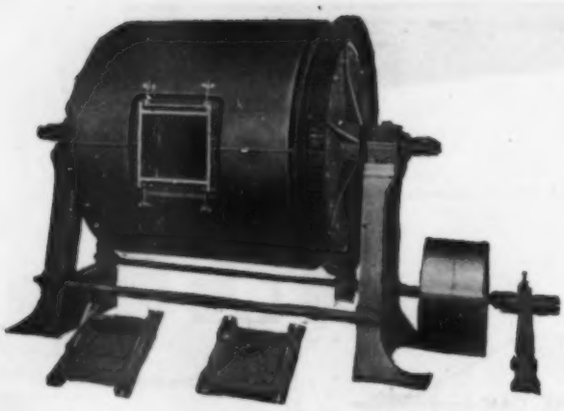

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Do you know that the various processes of Chemical Reaction, Distillation, Drying, Heating, Grinding and Mixing Chemical Products can be efficiently performed in one continuous operation—in an ABBÉ PEBBLE or BALL MILL? Have you fully investigated the possibilities for economies by using a specially designed ABBÉ PEBBLE or BALL MILL for various processes in chemical manufacture?

There are opportunities here for huge yearly savings which, we feel, are not yet fully appreciated. Our experience with installations of specially designed ABBÉ BALL and PEBBLE MILLS has time and again demonstrated that extra equipment and extra handlings, often held to be indispensable, can be frequently eliminated by combining several operations into one with an ABBÉ PEBBLE or BALL MILL.

You, too, may be indulging the extravagance of similar wasteful practises right in your own plant. If you are transferring materials from vats to agitators, from agitators to grinding mills and mixers—let us determine if these several operations can not be more simply and economically handled in one machine—an ABBÉ BALL or PEBBLE MILL.

ABBÉ ENGINEERING CO.

42 Church St., New York

Cortlandt 0054-55-56

Branches

BOSTON BUFFALO BALTIMORE
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Chemical Engineering Equipment Co., Montreal, Canada

Just Off the Press

Our new catalog No. 27
showing our complete line
of Machinery
for the Chemical Engineering
Industries.

Have you received your copy?

If not, please write
our nearest sales office.

BAKER PERKINS CO., INC.

Werner & Pfleiderer Division

250 Park Ave.

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GRUENDLER

For Process Industries *Severest* Services

The name of Gruendler has stood for durability among users of reduction machinery for 43 years! Our past success is attested to by thousands of satisfactory installations now in service. We maintain a corp of skilled engineers that are at your service.

Gruendler Grinding Equipment includes:

Crushers
Pulverizers
Breakers
Grinders
Shredders

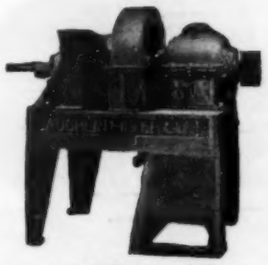
We invite correspondence as to your requirements.

GRUENDLER PATENT CRUSHER & PULVERIZER CO.

1103 Landreth Bldg., St. Louis, U. S. A.

Dewatering—Filtering

Better—Faster—Cheaper



Models A and B

1. Function without the aid of screens, cloths, or other media intended to pass liquids and retain solids.
2. Continuous in operation.
3. Require no auxiliaries.
4. Feed and discharge arrangements are extremely simple. No critical adjustments.
5. Operating and mechanical forces reduced to minimum.
6. Low speed of operation, 400 r.p.m. for easy settling materials at low capacities, 800 r.p.m. usual maximum.
7. Power required is very low.
8. Solids may be coarse, fine or mixed.
9. Limited classification of solids can sometimes be arranged.
10. Solids lighter than water can be handled by special modification.
11. Moisture content of solids discharge low.
12. Acid proof metals can be used in all essential parts.
13. Only wear is due to erosion and this is relatively slight. Wearing parts are replaceable.
14. Maag type gears; gear case water jacketed; weight 7,000 lbs.; ball bearing throughout; heavy construction; 4x6 ft.; 5 ft. high.

Model S

1. The screen is always clean, kept so by small blades set loosely in the edge of the screw contacting at all times with the screen, due to centrifugal force.
2. Washing where required, is complete, efficient and economical.
3. Continuous in operation.
4. Require no auxiliaries.
5. Feed and discharge arrangements are extremely simple.
6. Operating and mechanical forces reduced to minimum.
7. Low speed of operation, 400 r.p.m. for easily screened materials at low capacities, 1000 r.p.m. usual maximum.
8. Power consumption very low.
9. Acid proof metals can be used in all essential parts.
10. Only wear is due to erosion on the blades and this is slight. The blades are replaceable. Screen wear is exceedingly slow; screens are mounted separately to facilitate easy replacement in case of accident.
11. Spray heads for washing are easily removed for cleaning or adjustment.
12. Maag type gears; gear case water jacketed; weight 7,000 lbs; ball bearing throughout; heavy construction; 4x6 ft.x5 ft. high.

The Laughlin Continuous Centrifuge is a definite development in filter apparatus, destined to be of utmost importance to the process industries. Initial installations show marked superiority in performance and economy. Those in use the past year have met all expectations.

This filter is especially suitable for handling crystalline, fibrous and comparatively coarse materials, with or without washing, *and without an operator,* as is required in batch machines. Process manufactures will find it most desirable for certain chemicals, soap stock in oil, paper pulp, reclaimed rubber, salt, sugar, fibres and others of similar characteristics, as well as coal, clays and metallurgical products.

We have a large and complete experimental plant, with commercial size machines, for testing purposes. Arrangements can be made for tests and a complete report of same, without cost.

From these tests we can assemble a machine best adapted to fit a particular problem. Laughlin Centrifuges are built in capacities up to 10 ton, and over, per hour of dried delivered material.

Process concerns are invited to submit samples.

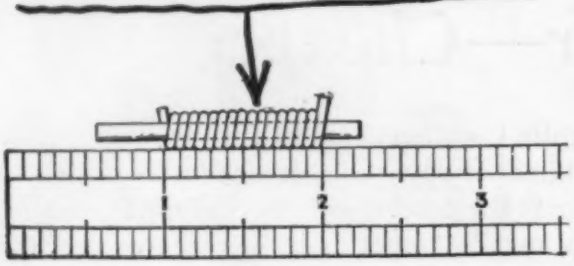
Laughlin Continuous Centrifuges are put in on a trial basis with an operating guarantee.

LAUGHLIN FILTER CORPORATION

331 Madison Ave. **New York, N. Y.**

LAUGHLIN Continuous CENTRIFUGE

Measuring Wire Diameter without a micrometer



The above sketch shows how it can be done with an ordinary rule.

Count the number of turns per inch and divide into one. Thus, if there are 50 turns per inch the diameter is (1 ÷ 50) .02 in.

But when applied to the finer NEWARK wires this method would not be so practical.

Take, for example, the wire .0014 in. in diameter used in our Testing Sieve No. 325. You would have to count 714 turns per inch! A micrometer is much quicker.

To be absolutely certain that our wire diameters are correct we do all wire drawing ourselves, in our large Newark plant. We have always exercised care in every operation so that we can POSITIVELY GUARANTEE every square inch of wire cloth that leaves our plant.

Made of every malleable metal, in every mesh, length, width and weave—aluminum, brass, copper, phosphor bronze, nickel, steel, gold, silver, platinum, nickel-chromium, tinned metals, special alloys, etc.

Fill in, Tear off, and Mail

Newark Wire Cloth Company

350-364 Verona Ave., Newark, N. J.

**Branch Office: 66 Hamilton St.
Cambridge, Mass.**

Without obligating me in the least,

Please send Catalog No. 26 to

Name .....

.....

Firm .....

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Address .....

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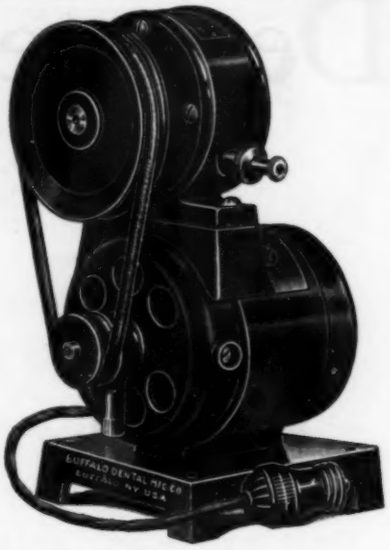
Ask us for Catalog B



A Motor Blower

supplying sufficient air for blowpipe or small furnace work, appealing especially to those who do not wish to install an expensive air compressor.

Buffalo Dental Manufacturing Co.
Kehr and Urban Sts., Buffalo, N. Y.

Perforated Metals and Mining Screens of All Kinds

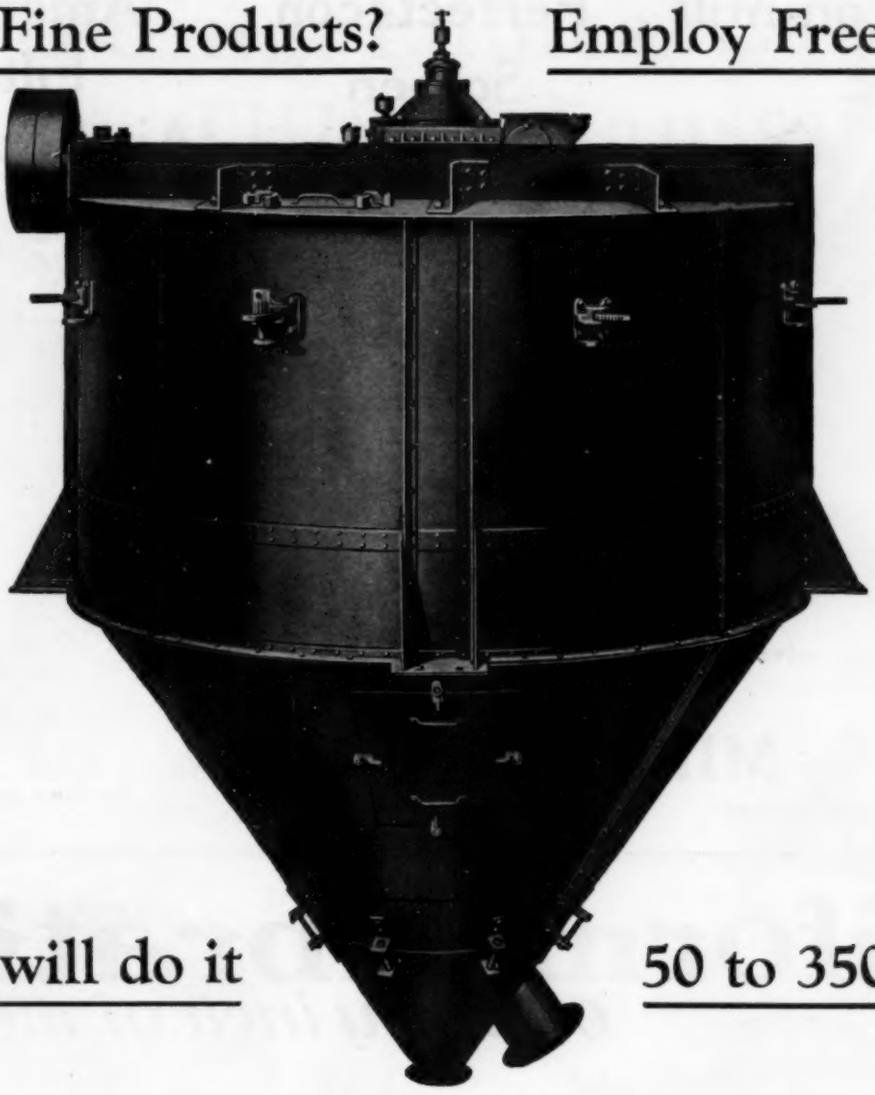
Any size or style holes, any thickness of metal, flat or rolled, to fit your equipment.

Tell us of your requirements

Prompt shipment

Chicago Perforating Co.
**2439 West 24th Place
CHICAGO, ILL.**
Tel. Canal 1459

Want Fine Products? Employ Free Air!



Air will do it 50 to 350 Mesh

Air Works When Screens Fail

Wind raises the dust, centrifugal force and gravity size and settle it

THE STURTEVANT WHIRLWIND CENTRIFUGAL SELECTORS
insure the quantity and quality of products

Your grinding mills will do more.
Your costs will be lower.
Your fineness is guaranteed.

Wouldn't you spend a comparatively small amount for a machine that will do this?

$500 up—2 H.P. up—Upkeep almost nil. No Supervision

STURTEVANT MILL CO.

Harrison Sq., Boston, Mass.

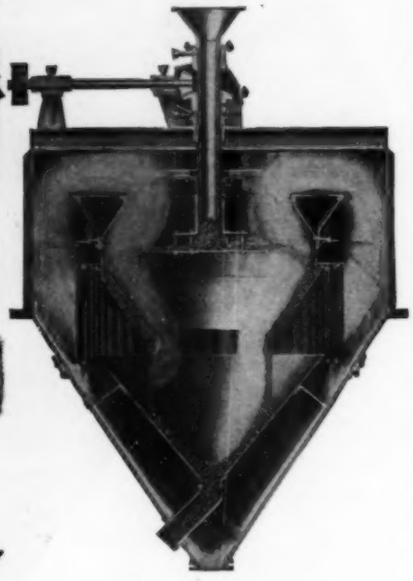
Maxecon Mill

for economical pulverizing

Perfectecon Screen

for coarse screening

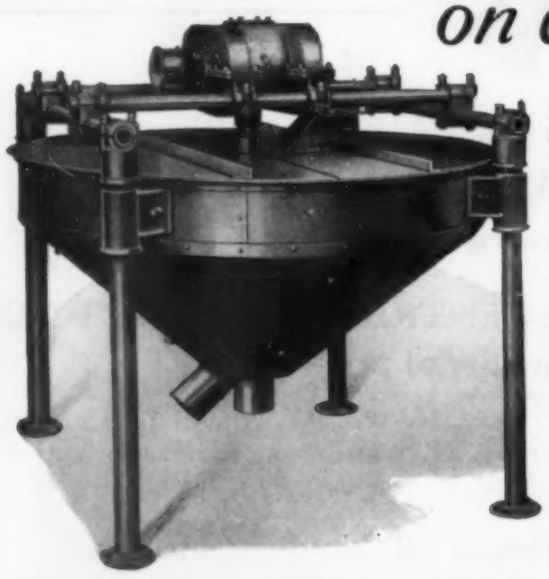
American Filter Air Separator



for fine separating

KENT MILL COMPANY
10 Rapelye Street **Brooklyn N. Y.**

Uniform Vibration
on every inch of the screen



Every inch of the screening area in a Telsmith Vibrating Screen is fully utilized—the whole screening circle vibrates uniformly. Yet the vibration is limited to the screening disc and its mechanism. The discharge hopper and its supports are entirely free of movement.

The screen has two independent movements: a vertical vibration at 850 impulses per minute (which screens the product) and a horizontal rotation at 23 R.P.M. which discharges it. The dish shaped screen tray prevents aggregate from gathering undue momentum, insuring full efficiency at the screen's outer edge. The screening cloth is not under tension—consequently wears far longer than in other vibrating screens.

Vibration is mechanical—no special electrical equipment is required. The screen may be driven from any available shaft, provided the proper speed is maintained. Bulletin V. S. 17 will give you complete information. Sent without cost or obligation. *Write for it today.*

SMITH ENGINEERING WORKS
1812 Holton Street Milwaukee, Wis.

Canadian Representative:
Canadian Ingersoll-Rand Co., Montreal, P. Q.

11 West 42nd St. New York City
Beckwith Mchy. Co. Pittsburgh, Pa.
Old Colony Bldg. Chicago, Ill.
Tower Mchy. Co. Cleveland, O.
80 Federal St. Boston, Mass.
Brandeis M. & S. Co. Louisville, Ky.

V.S.1

TELSMITH
Vibrating Screen

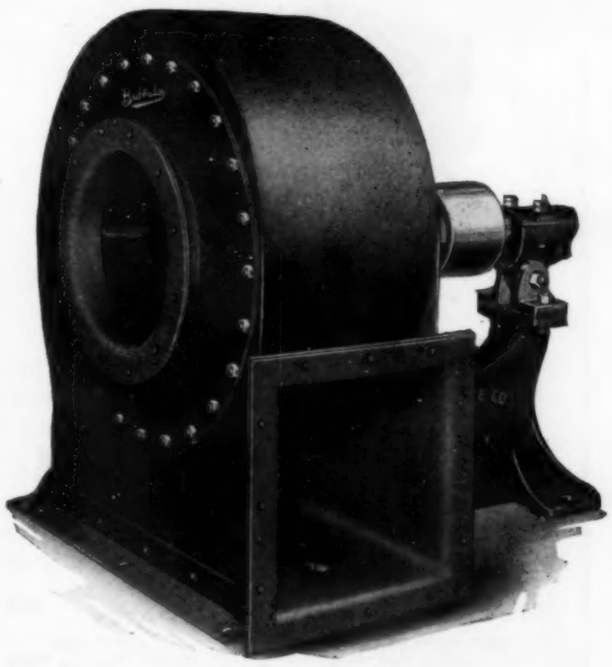
Corroding Fumes Cannot Act on THIS Exhauster—

IT'S completely shielded by a coating of pure, live rubber. Wheel shaft and interior of the housing —every part which comes in contact with the corrosive gases—is perfectly insulated from their penetrating action.

In addition these Rubber Coated Fans possess the same high mechanical efficiency of other "Buffalo" Fans. The design is the same, the only difference being that after assembly the exposed parts are coated with soft flexible rubber, vulcanized directly to the metal by the Vulcalock process of the B. F. Goodrich Co. This soft rubber will not crack, peel or loosen.

Buffalo Rubber Covered Fans are standing up under conditions which destroyed ordinary fans within a few weeks.

Coated with pure live rubber. Resistant to corrosion and wear.



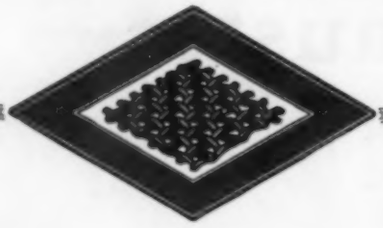
Write for Bulletin 2424-H. Describes Buffalo Rubber Coated Fans and lists the various acid and caustic fumes which they handle successfully.

Buffalo Forge Co.
501 Broadway Buffalo, N. Y.

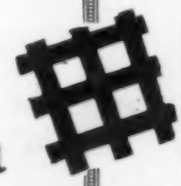
In Canada—Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

"Buffalo" **Rubber Coated Fans**
for handling corrosive fumes

Cleveland



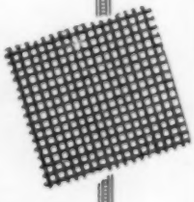
Pays to depend on a "Regular"



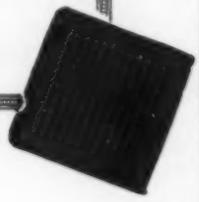
WIRE screen or cloth of irregular weave results in an irregular sized product, which is objectionable and detrimental. As everyone knows, over an extended period the lack of durability *alone* makes the irregular cloth far more expensive than the "regular."

"Cleveland" Wire Cloth *saves* you money. It is Regular.

You always can depend on "Cleveland" Double Crimped Wire Cloth to be regular and uniform in mesh; made of best-quality metals—with the extra strength and special screening advantages afforded by the "double crimp" feature.



Write for our latest Catalog—No. 2—describing "Cleveland" Wire Cloth and Screens, plain or rolled, in any desired mesh or slot and made from any metal. Many different weaves. Price Lists included.



The Cleveland
Wire Cloth & Mfg. Co.
3574 East 78th St.
CLEVELAND, OHIO

Wire Baskets

annealing-dipping-conveying

For fifty-eight years, baskets made of "Buffalo" Wire have ranked high where strength and long, dependable service is necessary. In foundries, for pickling castings, in plating works, in large machine shops, for annealing purposes, they have proven their worth.

"Buffalo" Wire Baskets can be made of any wire according to your specifications. Just let us know your requirements and we will gladly quote prices. Send for Catalog 8GG.

BUFFALO WIRE WORKS CO., Inc.
(formerly Scheeler's Sons)
Est. 1869
482 Terrace, Buffalo, N. Y.

BuffaloWIRE
"A BETTER WIRE CLOTH"
MADE UP TO A STANDARD—
NOT DOWN TO A PRICE
101

Cussin'

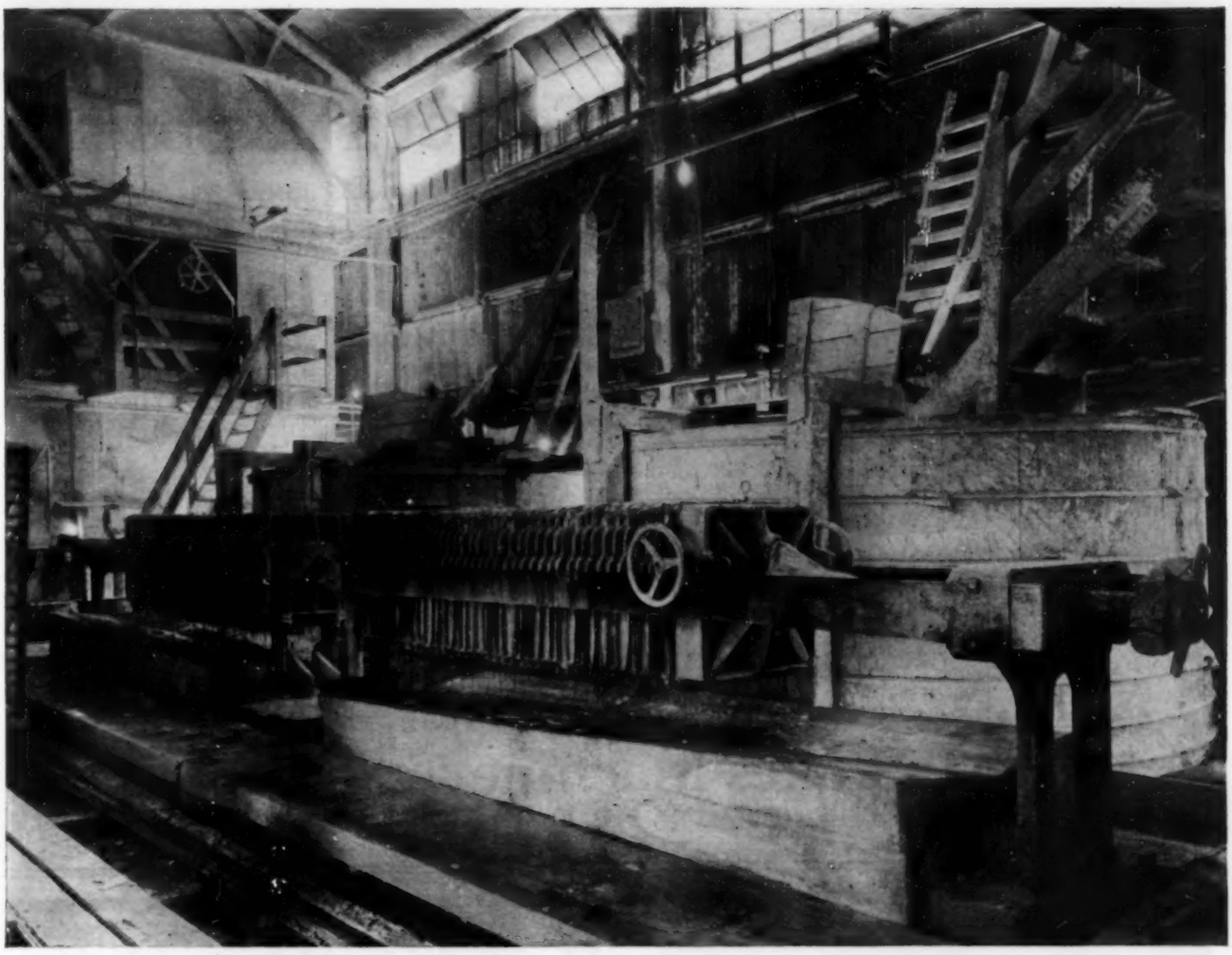
a "lazy" screen doesn't get the job done. That's why more and more users are depending on the *LINK-BELT Vibrating Screen*—an *energetic* screen with an unobstructed surface uniformly vibrated over its entire area.

Write for Catalog 862.

3010

LINK-BELT COMPANY
PHILADELPHIA, 2045 Hunting Park Ave.
CHICAGO, 300 W. Pershing Road
CLEVELAND, 527 Rockefeller Bldg.

LINK-BELT
VIBRATING
SCREEN



Earning Extra Dividends with SHRIVER FILTER PRESSES

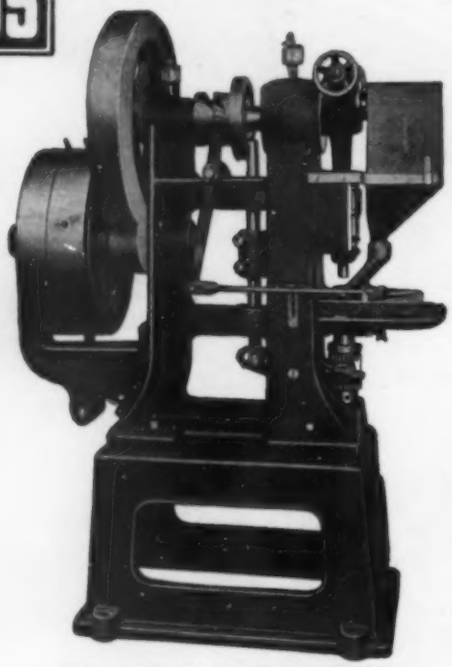
Like so many of the foremost Chemical Companies, the Chemical and Pigment Company at Baltimore, Maryland finds Shriver Filter Presses the most practical and efficient—and therefore the most economical method of filtration.

Shriver Filter Presses are being specified more and more by manufacturers who judge each press, set up and operating, by ultimate results. One of the largest manufacturers of chemicals in America found that Shriver Filter Presses meet—most efficiently and economically—the exacting requirements of nitro-cellulose lacquer manufacture. Already more than 250 presses have been installed in this company's various plants. *It found they pay.* There is a Shriver Filter Press for every filter need. Our engineers will gladly consult with you and help with your filtration problem—without obligation.

T. SHRIVER & COMPANY
808 Hamilton Street, Harrison, N. J.

SHRIVER

FJS



TYPE "T" TABLET MACHINE

FJS

STOKES

Tablet Presses

are making good

in the manufacture of these products:

Bakelite Preforms	Ink Tablets
Napthalene Balls	Carbon Brushes
Glass Insulator Beads	Mint Candy
Electrical Porcelain	Laundry Blue
Fertilizer Tablets	Grinding Wheels
Water Color Paints	Incense Cones

Metallic Motor Brushes

And, of course, the hundreds of varieties of medicinal and pharmaceutical products.

Tablet making methods have cut production costs in many lines.

Can you use a Tablet Machine?

Free CONSULTING Service

F. J. Stokes Machine Company

5820 Taber Road, Olney P. O., PHILADELPHIA

Small Williams Grinder in Southern Soap Powder Plant. Other Williams users include such well known firms as Kohnstamm & Co., Allen B. Wrisley and Fitzpatrick Brothers.

Williams Hammermills also reduce

Asbestos,	Wood Flour,	Animal By-products,
Leather,	Bark,	Coal,
Paper & Pulp,	Chips,	Spices,
Oil Cake,	Cork,	Sewerage Sludge,
Limestone,	Dry Chemicals,	Glass,

Yes, we build Soap Powder Grinders

The excellent soap and washing powders ground with Williams mills are typical of the many other products successfully crushed, ground or shredded with one or another of the 300 or more Williams machines. In the soap powder grinder a force feed assures non-clogging on the mill while the current of air through the grinder and pneumatic conveying system hardens the outer shell of each particle and considerably reduces the tendency to pack in the package. If you have anything to crush, grind or shred from limestone to feathers, describe your work and let us send data.

Williams Patent Crusher & Pulv. Co.

2706 North 9th St., St. Louis, Mo.

Chicago	New York	San Francisco
37 W. Van Buren St.	15 Park Row	415 5th Street

THE WILLIAMS PATENT CRUSHER & PULVERIZER CO. ST. LOUIS, MO. U.S.A. TRADE MARK

REG. U.S. PAT. OFF.

Williams

ORIGINAL PATENTEES AND WORLD'S LARGEST BUILDERS OF HAMMERMILLS

Williams

PATENT CRUSHERS GRINDERS SHREDDERS

Leather Dressings for Instance

Whatever formula is used, the Premier Colloid Mill produces infinitely more than is obtainable by ordinary procedures

Going into actual competition with the old established methods used in the disintegration of solid, plastic, or liquid masses into colloidal particles is an easy way to prove the overwhelming superiority of the *Premier Colloid Mill.*

The preparation of Leather Dressings gives an indication of the value of the Premier Mill. These mixtures usually consist of:

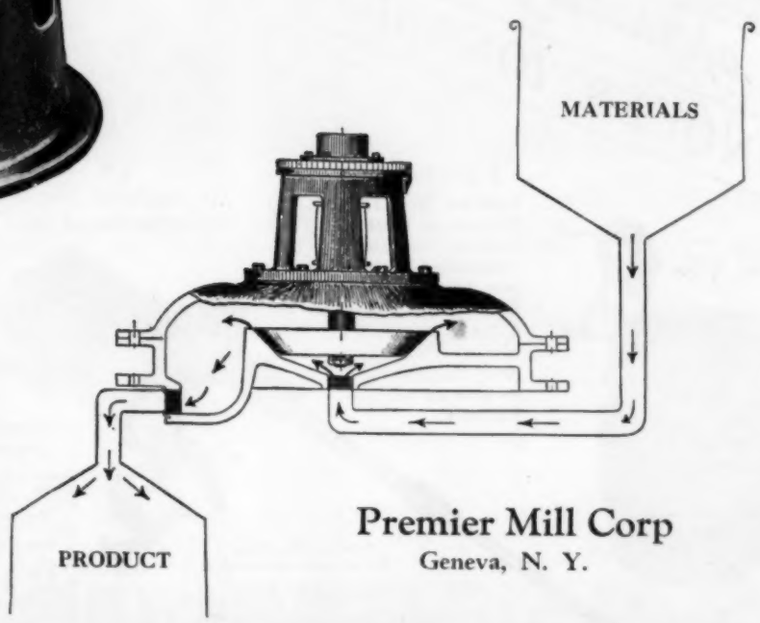
1. Nitrocellulose Base and Pigments.
2. Nitrocellulose Base, Caster Oil and Pigments.
3. Olive Oil and Shellac Solution and Pigments.
4. Casein and shellac solutions containing Pigments.

This mill is not of the Attrition type. It is a Disintegrator in which liquid shear produces a mixture reduced to an extremely fine state of sub-division. And in addition, you have a continuous process.

Chemical reactions, mechanical features, power consumption,—all this and any other data you may require are yours for the asking.

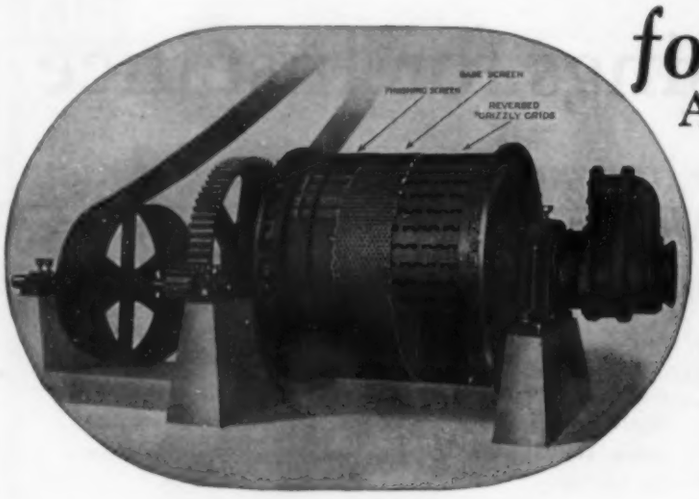
These Products indicate the revolutionary uses of Premier Mills:

Asphalt Emulsions
Bakery Compounds
Chocolate Syrup
Color Pastes
Cosmetics
Emulsions
Enamels
Extractions
Inks (Carbon Paper)
Lacquers
Leather Dressings
Linoleum Paints
Milk of Magnesia
Oil Refinery Processes
Paints
Perfumes
Regenerated Milk and Cream
Resin Emulsions
Soup
Textile Emulsions



Premier Mill Corp
Geneva, N. Y.

PREMIER COLLOID MILLS



for GRINDING ABRASIVE MATERIALS

If you have a hard, tough, abrasive material to be ground—here is a simple way to take the annoyance out of it and to do a thorough job. The Herman Mill suits the conditions of dry grinding, "it grinds, screens and discharges all in one operation," it gives a uniform product and requires practically no attention. At one plant a Herman Mill has a record of 170 continuous eight-hour shifts without even stopping the motor—and it was a tough job, too—one on which many types of ordinary grinding machines failed utterly.

Write for Bulletin No. 424, or better yet, let us know your problems and our engineers would be glad to consult with you as to the adaptability of this mill to your work.

THE HERMAN MILL GRINDS WET OR DRY

It entirely obviates the necessity of the installation of over-size return equipment. The material is extruded as ground to size—the oversize remains in the drum until similarly ground.

Testing plant facilities maintained for samples of 300 pounds to a carload.

The Braun Corporation

362 New High St.
Los Angeles, U. S. A.

San Francisco House
Braun-Knecht-Heimann Company

Does Quicker Mixing appeal to you? UNQUESTIONABLY!

LIGHTNIN Portable Mixers

have done more to reduce fluid mixing costs and produce a more uniform product than any fluid mixing method yet devised. Thousands of users tell us so. What they are doing for others they will do for you.

With few exceptions the greatest process industries throughout the world are using and in many cases have standardized on "Lightnin" Equipmentfor fluid mixing.

Model "C" Direct Drive ⅛ HP., ¼ HP.

FEATURES

Vertical Ball Thrust Motors — Outboard Bearing for Shaft—Telescopic Shaft, Adjust to any Angle—Ball and Socket Clamp—Motors Properly Housed—Clean—Sanitary.

Patents Pending.
All Claims Allowed.

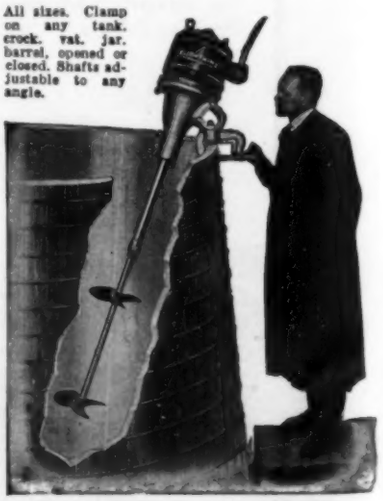
WRITE FOR CATALOGUE D 22

GEARED TYPE

Geared to 430 R.P.M. 383 or 287 R.P.M. at P.c. ellor.
Ball Bearing Throughout
Sizes: ⅛ H.P., ½ H.P., 1 H.P., 1½ H.P.
Heavy Duty Models.

DIRECT DRIVE

All sizes. Clamp on any tank, crock, vat, jar, barrel, opened or closed. Shafts adjustable to any angle.



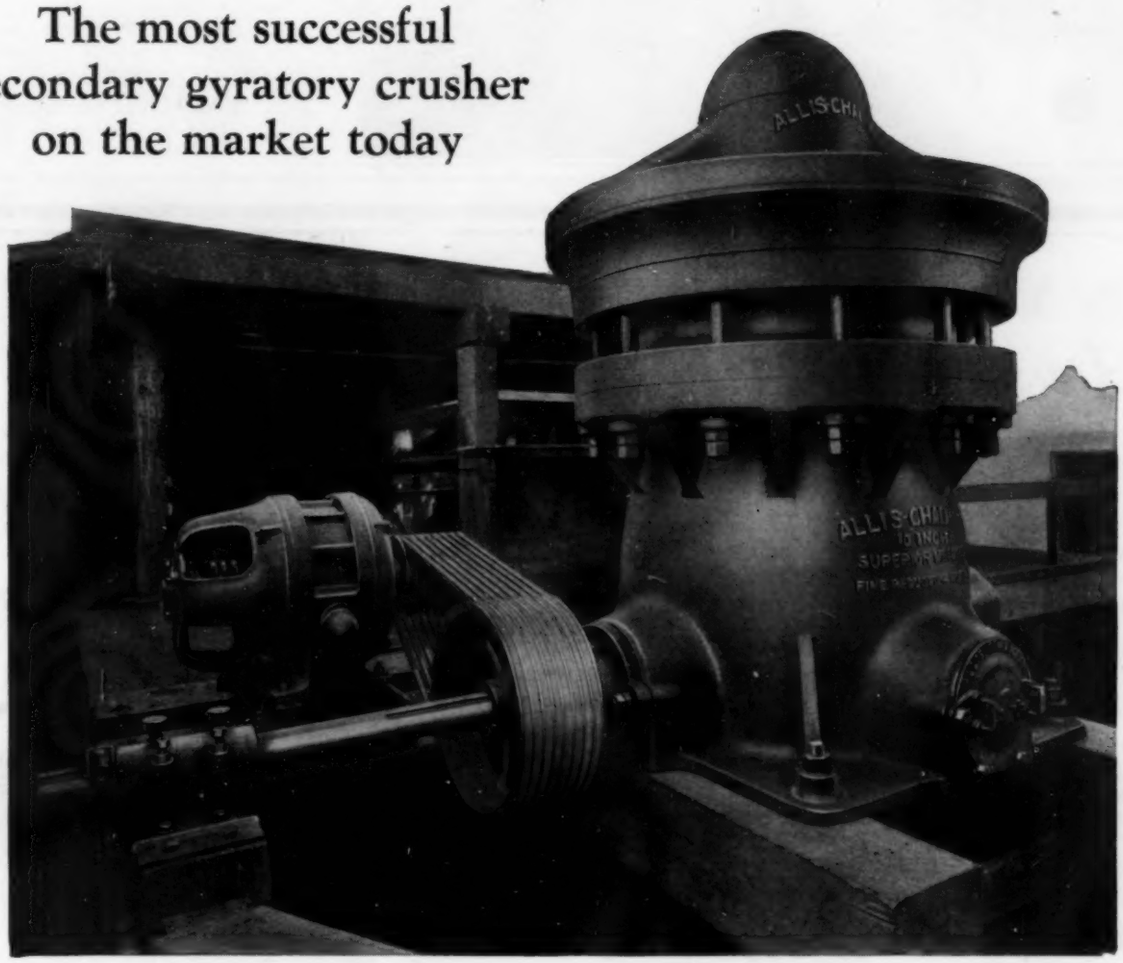
MIXING EQUIPMENT CO., Inc.

Originators and World's Largest Manufacturers Portable Electric Mixing Equipment

229 East 38th St., New York, N. Y.

Superior McCully Fine Reduction Gyratory Crusher

The most successful secondary gyratory crusher on the market today



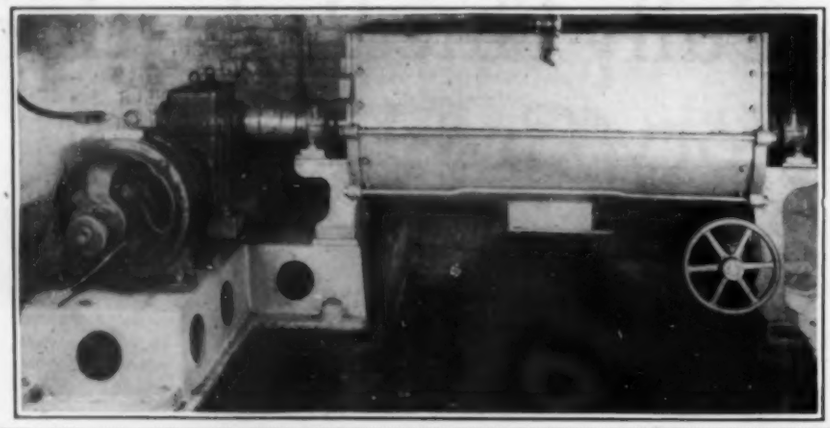
10-Inch Superior McCully Fine Reduction Crusher driven through Texrope Drive from 75 H.P. Type "ARY" Motor. Crusher, motor and drive are all of Allis-Chalmers manufacture.

SIZES, CAPACITIES, HORSE POWER AND WEIGHTS

Size of Crusher in Inches	Two Feed Openings, Size Each in Inches	Capacity Per Hour in Tons of 2,000 Pounds — Size of Discharge Opening in Inches												Driving Pulley		H.P. Required	Weight of Crusher in Pounds
		¾	⅞	1	1¼	1½	1¾	2	2¼	2½	3	3½	4	Size in Inches	R.P.M.		
6	6x40	24	28	32	40	48								36x12½	500	40 50	32,000
10	10x52					80	94	107	120	1 5				36x19	450	75 100	64,000
18	18x68									250	300	350	400	44x25	400	150 200	182,000

ALLIS-CHALMERS

MILWAUKEE, WIS. U. S. A.



Introducing
The STANDARD MIXER

27 years of good will back of it. We are offering this fine machine to the chemical and Allied industries. We are sure it will meet with your requirements for all kinds of dry or damp materials. You will find it is better built, will give you more years of service, with less upkeep than machines of this type you have been using.

Built in three sizes.
Inquiries solicited.

THE STANDARD SAND & MACHINE CO.
5151 St. Clair Ave.,
Cleveland, U. S. A.

CAN YOU USE
Hydraulic Pressure
IN YOUR PROCESS?

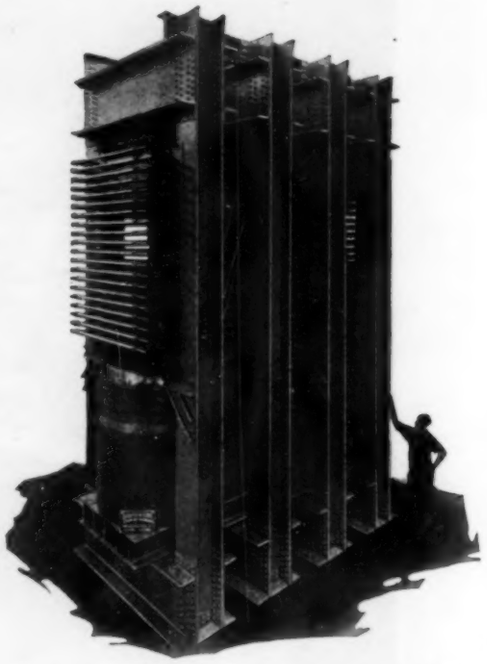
If so, you will find the press you need in Southwark's large stock of standard and special machines. We have them for every purpose, covering a wide range of industries, and are constantly adapting them to new operations.

When you require either standard or special hydraulic equipment, let Southwark Engineers show you the press exactly suited to your work.

Among our standard machines are

Dehydrating Presses
Pulp Presses
Curb Presses
Briquetting Presses
Baling Presses
Platen Presses for moulding and curing Rubber, Bakelite, Redmanol and composition materials.
Collodian Presses
Extrusion Presses for metal, lead cable covering, etc.
Hydraulic Presses for every purpose.

SOUTHWARK
FOUNDRY & MACHINE CO.
426 Washington Ave., Philadelphia, Pa.
CHICAGO—343 S. Dearborn St. AKRON, OHIO—100 E. South St.



2000-Ton, 20-Opening, 12-ft. 6-in. x 4-ft. 6-in. Southwark Steam Platen Press

SUPERFINE DRY GROUND MATERIALS
can only be produced by using the
Gayco Dry Centrifugal Separator

Seven years' successful operation has demonstrated the superiority of this wonderful machine over all methods of air and water separation.

It separates practically all fine dry materials, giving products from 80 to 350 mesh, as desired. Requires but little power to operate and costs almost nothing for upkeep.

Six Sizes from 30 Inches to 14 Feet in Diameter

Rubert M. Gay Company, Inc., 114 Liberty Street, New York, N. Y.

Pop says he's not to blame.

"Listen, Lad—

here's a letter blaming our construction of tanks because of the embrittlement of the steel where caustic solutions are involved.

Now I saw a study in Chemical & Metallurgical Engineering, of the causes. It's rather a mysterious subject and I don't see where we are to blame any more than the steel maker."

A new textbook on Arc Welding (Price $1.50) will be sent on approval for five days to any executive requesting it. Book size, 6" x 9"—total pages, 160—number of illustrations, 200—Charts, 62—Divisions, 8.

"Yes, Pop—

because if you'll look at the photos in the article you'll see that the *seams follow along rivet holes.*

While we don't understand the causes of cracks in steel we DO know that rivet holes don't need to be in tanks.

We don't need to weaken the structure of the sheet by punching it full of holes.

With "Stable-Arc" welding we not only leave the sheet in its full strength—but we actually ADD metal.

In other words, instead of the joint being the weakest part as in riveting it is actually the strongest part by the "Stable-Arc" welding process. (See pages 31 to 38 in the Welding Book.)

If cracks interfere with riveted construction—give up rivets."

The Lincoln Electric Co., Dept. No. 6-11, Cleveland, Ohio

W-24

"Linc-Weld"

LINCOLN MOTOR

THE ELMORE CONTINUOUS CENTRIFUGAL

It took a long time for man to grasp the fact that machines could be made to do the work of men. Yet, today, there is no doubt in any man's mind that labor saving machinery results in lowered production costs.

It has taken years of experience in designing automatic and continuous equipment, to put the

ELMORE CONTINUOUS CENTRIFUGAL

on the market.

ELMORE ENGINEERS have done the pioneering, and an ELMORE CONTINUOUS CENTRIFUGAL will meet the most rigid requirements for Continuous Performance.

THE MARK OF ELMORE ECONOMY

Fuller Bldg.—G. H. ELMORE—Philadelphia

Hy-Speed

ELECTRIC INTERNAL PRESSURE FILTERS

PORTABLE ELECTRIC MIXERS Clamp to any tank. Mix all liquids. Cost Less. Last Longer.

Write for our complete catalogue of Liquid Handling Equipment

ALSOP

Hy-Speed Machines ENGINEERING COMPANY

47 West 63rd St. New York

Products of Quality

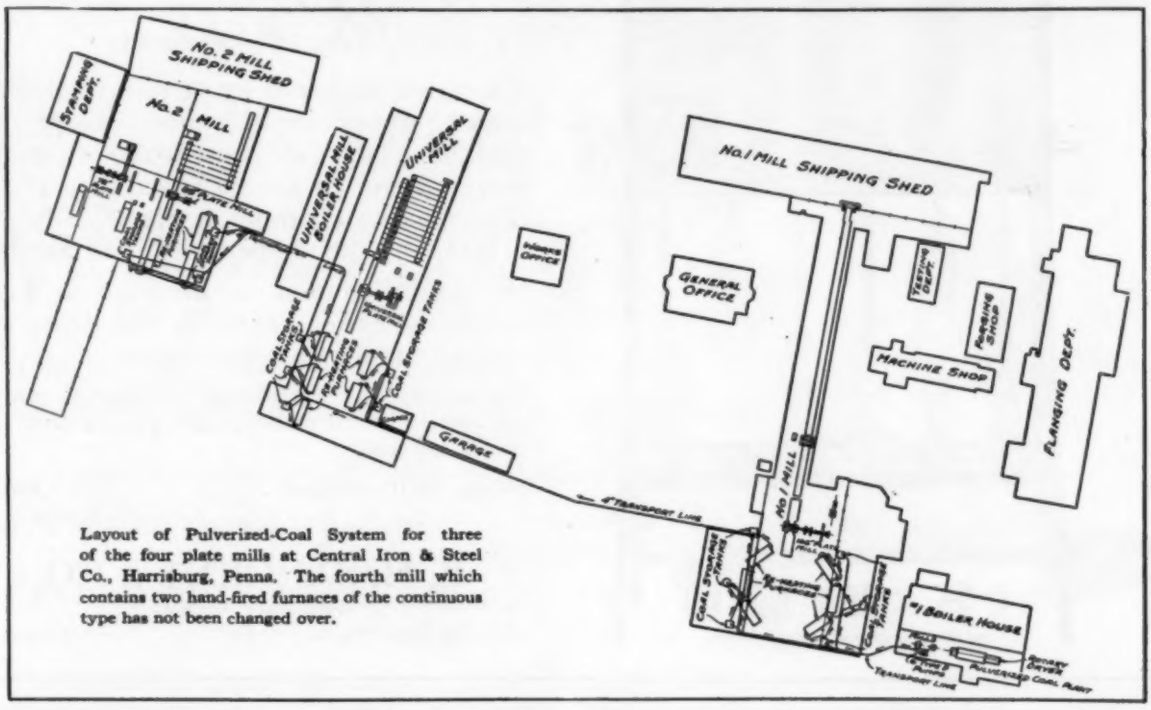
Are recognized as STANDARD EQUIPMENT in liquid chemical manufacture. They differ distinctly from other types of machinery in that:

1. **There is no installation cost.**
2. **Experienced operators are unnecessary.**
3. **Quantity manufacture with interchangeable parts insures minimum upkeep expense.**
4. **Experience in manufacturing OVER 25,000 Hy-Speed Products is a guarantee of performance and service.**

A Serial Story about

Pulverized-Coal Equipment for Plate-Mill Furnaces at Central Iron and Steel Company

(The second advertisement will appear in the next issue of this magazine. Watch for it.)



Layout of Pulverized-Coal System for three of the four plate mills at Central Iron & Steel Co., Harrisburg, Penna. The fourth mill which contains two hand-fired furnaces of the continuous type has not been changed over.

Officers Decided on Pulverized Coal because of Lower Operating Costs and Flexibility

THE Central Iron & Steel Company, Harrisburg, Penna., has four plate mills, widely separated, which were originally served by a total of 15 heating furnaces and one soaking pit. Of these furnaces, seven were regenerating gas furnaces served by two separate gas-producing plants. The remaining furnaces were hand-fired, air-blast furnaces, while the soaking pit was gas-fired but not regularly employed.

The outstanding item in the cost of manufacturing steel plates was the cost of re-heating in the mills. After a thorough investigation the officers decided that pulverized coal, with a central pulverizing plant, represented the greatest opportunity for cost reduction. It would enable the company to manufacture a wide range of products and to operate economically when only a portion of its capacity was employed.

Fuller Lehigh Pulverized-Coal Equipment was installed. After three years' operation President Robert H. Irons says: "The substantial reduction in costs, due to powdered coal cannot be measured by a comparison of direct costs only, such as fuel and labor, as the collateral benefits of this important installation are many. Lower costs when the mills are operated intermittently, lower furnace maintenance, elimination of ash handling, lower operating labor costs around the furnace, stimulation of production due to increased heating capacity, better heating and an improvement in quality, all can be attributed to the use of powdered coal."

Slabs and ingots weighing from 150 to 11,000 lb. are now being successfully and economically heated in the pulverized-coal fired furnaces.

Future advertisements will tell more about the features of this installation. Watch for them.

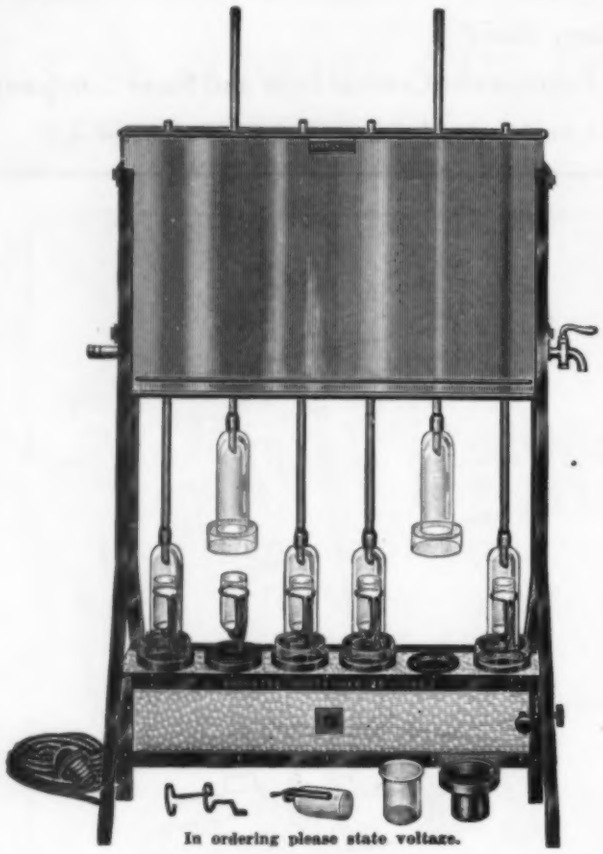
500

If you are interested in reading Mr. Irons' complete story about this installation ask us to send you, gratis, a copy of his article entitled, "Powdered Coal for Plate Mills," which appeared in August 25 issue of The Iron Age.

FULLER LEHIGH COMPANY

[A Babcock & Wilcox Organization]

FULLERTON----PENNSYLVANIA



In ordering please state voltage.

Sargent's Electric Extraction Apparatus

Type "B"—Patented

The latest design of extraction apparatus, which eliminates all joints except one mercury joint so constructed that the mercury trough always remains in place. The heating chamber is electrically operated, and the temperature is adjustable.

A beaker is used in place of a flask, affording easier access to the dried extracted matter and for cleaning.

The sliding condenser tubes and thermostatic control are covered by our patents; other patents cover our special features.

Price, as illustrated.....$90.00

Descriptive circulars upon application

E. H. SARGENT & CO.

Laboratory Supplies

155-165 East Superior St. Chicago

PALORIUM

Palorium is a new alloy having properties better suited for a platinum substitute than any other alloy that we have ever offered.

It has a high melting point, resists the action of mineral acids, alkalies and does not oxidize even at high temperatures.

In some cases Palorium is superior to platinum; for instance, it resists potassium hydroxide fusions and sulphuric acid better than platinum.

Made in various forms including crucibles, dishes, cathodes, triangles, wire, filter cones, etc.

Write for Bulletin 1215-P

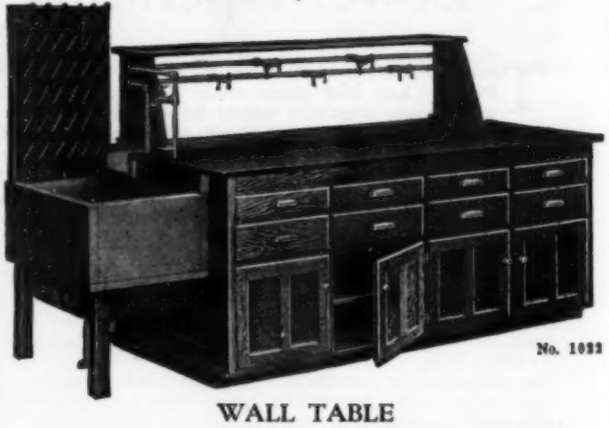
PALO COMPANY

Apparatus for Industrial and Laboratory Use

153 West 23rd Street New York, N. Y.

PETERSON

Laboratory Furniture



No. 1021

WALL TABLE

This arrangement of this table adapts it especially for professor's private offices, pathological and industrial laboratories.

The success of industrial research is often determined by the laboratory equipment used.

PETERSON industrial laboratory equipment represents over thirty-five years of specialization.

Write for Catalog No. 14-C

LEONARD PETERSON & CO., INC.

Office and Factory

1222-34 Fullerton Ave., Chicago, Illinois

Distributors conveniently located to serve you.

Have You a Copy of Our *Data Concerning Platinum* In Your Bookcase?

WE publish a book, *Data Concerning Platinum*, which we will send to you without charge and which you will find very valuable for reference. It consists of 84 pages and besides illustrations and descriptions of platinum laboratory ware made by us, it contains valuable data conveniently arranged under these headings:

Historical Summary of Platinum; Occurrence of Platinum Ore; The Platinum Metals; Uses of Platinum, Its Allied Metals and Alloys; Some of Our Products and Their Application; Platinum Ware; Notes on the Use and Care of Platinum Ware; Cleaning (Platinum Ware); Physical Properties of Platinum; Table of Electromotive Force—Temperature Relation in Millivolts and Degrees Centigrade; Table of Atomic Weights, Specific Gravities, Weights Per Cubic Inch, Specific Resistances and Melting Points of the Commoner Elements; Table Giving Specific Gravities and Troy Ounces Per Cubic Inch of Some Metals and Alloys; Weights Per Foot of Platinum Wire in Troy Ounces and Grams; Number of Feet of Platinum Wire Per Troy Ounce; Number of Feet of Platinum Wire Per Gram; Weight Per Square Inch of Platinum Sheet; Number of Square Inches of Platinum Sheet Per Troy Ounce; Number of Square Inches of Platinum Sheet Per Gram; Comparative Tables of Lengths, Areas and Volumes; Comparative Table of Troy, Avoirdupois and Metric Weights; Fractional Parts of an Inch Expressed in Thousandths; Millimeters Expressed in Inches; Comparison of Wire Gauges; Mensuration of Surfaces and Volumes; Method of Calculating Weight of Wire; Area and Circumference of Circles.

We shall be glad to send a copy to you, if you want one.

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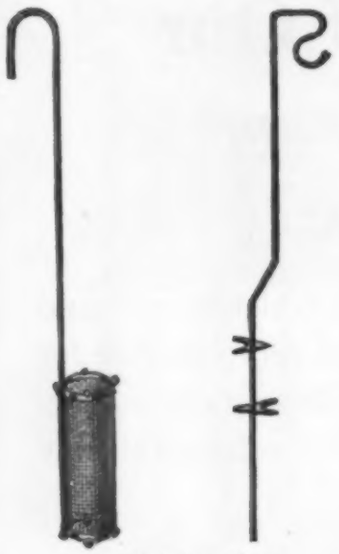
54 AUSTIN ST., NEWARK, N. J.
30 Church St., New York **5 So. Wabash Ave., Chicago**
760 Market St., San Francisco

Do Micro-Analyses Interest You?



Micro Electrodes (Pregl)

(We do not supply glass beads, they are shown merely for illustration.)

APW

IF so—it will be of further interest to know that the platinum equipment for your investigations can be supplied accurately to specifications and descriptions of an authority on the subject by the APW organization.

Besides the micro-electrodes illustrated we are prepared to furnish micro-boats and micro-crucibles, regular and Neubauer form, all as described in "Die quantitative Organische Mikroanalyse," by Fritz Pregl.

Our facilities are always available for producing platinum apparatus for research work according to authoritative texts, or made according to the individual chemist's own ideas. These last are treated with strictest confidence.

Our regular line of wares is shown in Catalog E-15. Copy sent on request.

AMERICAN PLATINUM WORKS
N. J. R. R. Ave. at Oliver Street, Newark, N. J.
New York Office: Charles Engelhard, 30 Church St.

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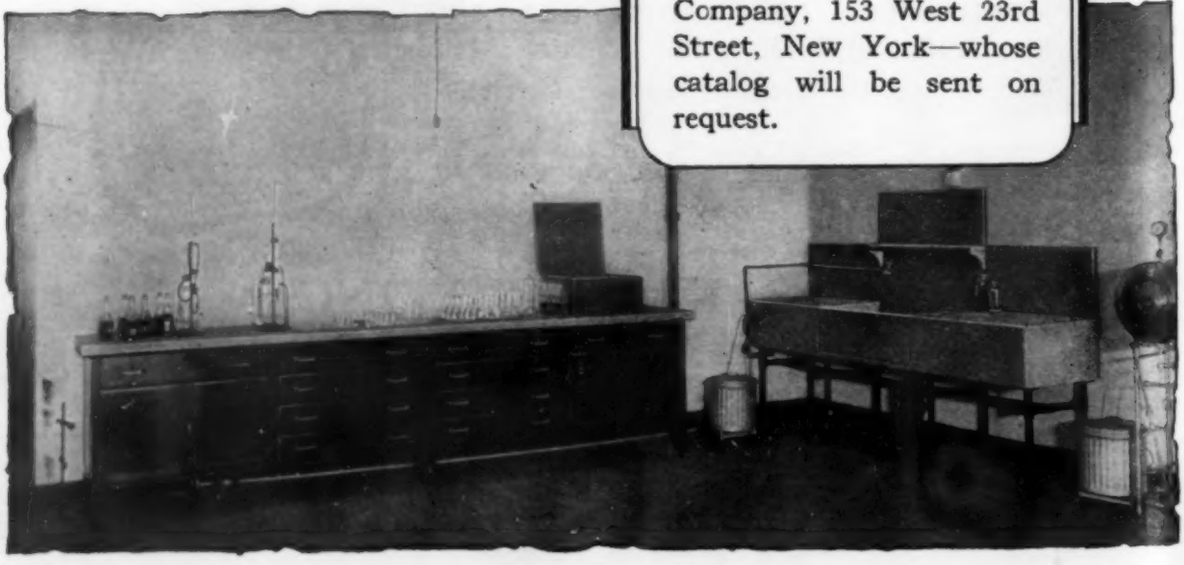
ALBERENE BEST STONE

Bacteriological laboratory, H. J. Heinz Co., Pittsburgh, Pa.

Table top, sink, drainboards, shelving, of Alberene Stone.

THE material preferred in every important laboratory erected in the past 20 years—for table tops, shelving, fume hoods, sinks, tanks, acid storage, and other fixed laboratory equipment—quarried and fabricated by Alberene Stone Company, 153 West 23rd Street, New York—whose catalog will be sent on request.



UNIQUE!

The design of the fine adjustment mechanism in the

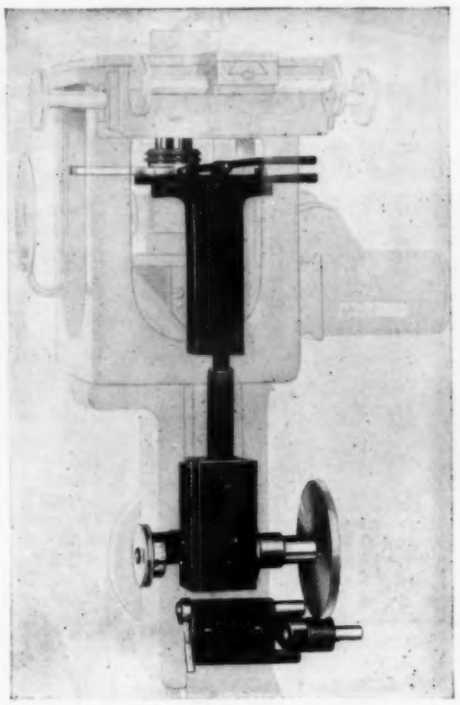
Bausch & Lomb

Large Metallographic Equipment

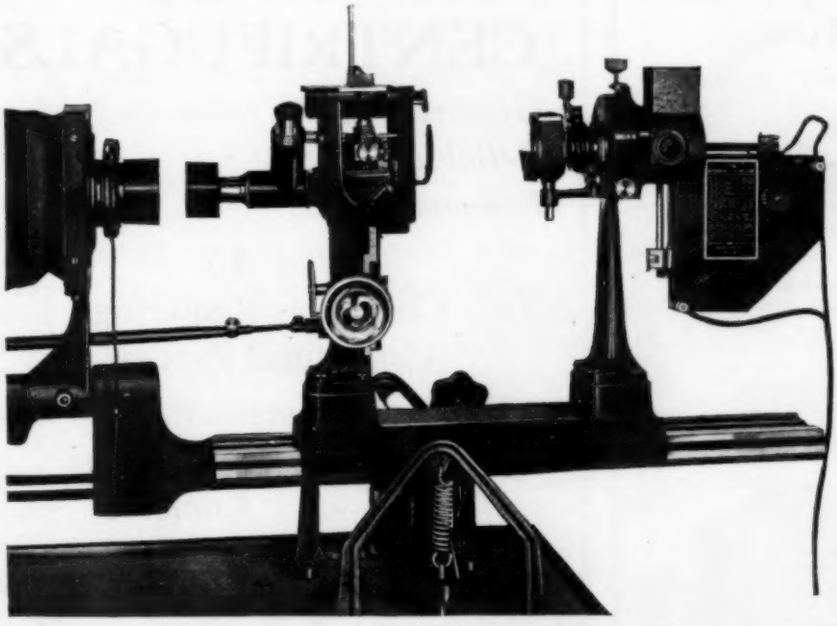
is entirely new and *different from that in any other equipment.*

One of the causes of change of focus during long exposures has been the absorption of heat and consequent expansion of the vertical illuminator and objective mount.

In this instrument, for the first time, the objective alone is supported by the fine adjustment mechanism, entirely separate from the vertical illuminator. It is, therefore, not affected by heat from the illuminant nor weight of the specimen. The elimination of all unnecessary weight from the fine adjustment together with the extension reduction gears for use while focusing on the ground glass, permits much finer and smoother focusing under unusually high magnifications.



Phantom view of microscope showing the fine adjustment and reduction gears.



Permanently aligned illuminating and microscope unit.

Permanently Aligned

Characteristic of the thought and experience behind the design of this instrument is the permanently aligned illuminating and microscope unit. This requires no adjusting for center and thus contributes to the ease and speed of manipulation of the apparatus. It also produces a far more accurately centered beam than can usually be obtained in a hurried adjustment of the older type of instrument.

Write for descriptive booklet.

BAUSCH & LOMB OPTICAL COMPANY

601 St. Paul St., Rochester, New York

Heusser Balances Save Time and Money

Ease, speed and accuracy in weighing are distinguishing qualities of Heusser Balances.

HEUSSER ANALYTICAL BALANCES are equipped with indestructible Stellite edges.

Both the Analytical and Assay Balances can be furnished with or without keyboard-operated Multiple Weight Attachment, Electrical Illuminator and other special features. The Assay Balances may be equipped with Mechanical Pan Extractor.

Standard features include one-piece truss beam with agate knife edges, unit base and releasing mechanism, and all-metal casing. Easy reading is an outstanding merit. Send for special Heusser bulletin.

WEIGHING ROOM IN A MODERN MINE LABORATORY (NOTE THE HEUSSER BALANCES)

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WILFLEY TABLES
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The MINE and SMELTER SUPPLY COMPANY

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McDanel Refractory Pyrometer Tubes and Protection Tubes

Years of experience in the refractory porcelain business plus a large number of tests of actual operation assure you that McDanel Products are right in every respect. In these tests, McDanel Tubes have proven to be far superior to various other makes. It will pay all pyrometer users to specify McDanel Tubes with their instruments or next replacement order from their instrument makers.

We have also developed a very successful combustion tube for carbon determination which has met with marked success.

TRADE MARK

McDanel Refractory Porcelain Co.
Beaver Falls, Pa.

Write for complete information on McDanel Products.

WESTON CENTRIFUGALS

Original (1866)
Reliable
Economical

For All
Chemicals Requiring
Centrifugal Process

Automatic Sprayers for Washing Contents

Sizes 20-inch to 40-inch.
Materials of construction adapted to product

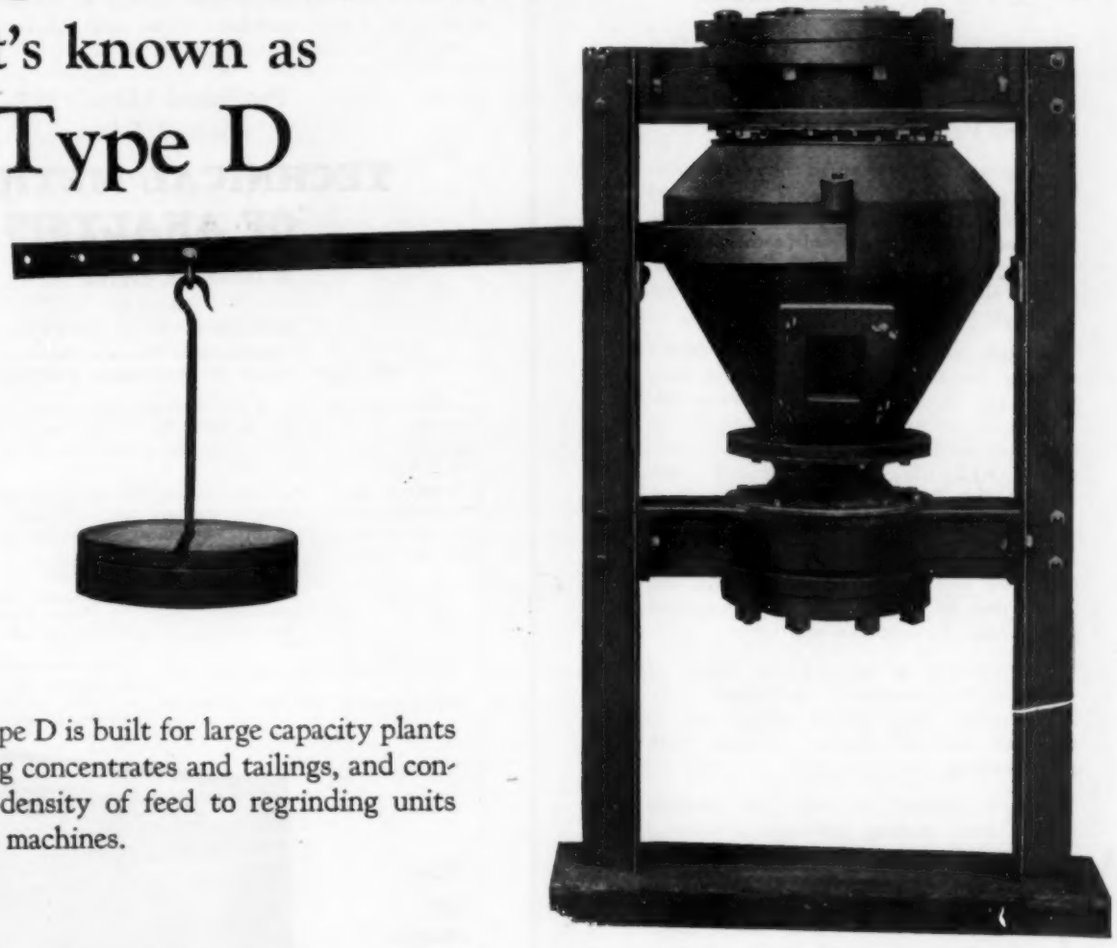
Established 1843
AMERICAN TOOL & MACHINE COMPANY
Trade Mark Registered U. S. Patent Office
BOSTON

This is the Big Brother

of Type A Bradley Automatic Density Valve

It's known as

Type D



The new Type D is built for large capacity plants in dewatering concentrates and tailings, and controlling the density of feed to regrinding units and flotation machines.

The extraordinary success of Type A, covering a wide variety of installations, has produced a demand for a valve of great capacity. This is met in the new Type D, which is quite similar to our standard sizes, except steel connecting hangers and vertical movement of floating pot being much greater in proportion.

After twelve months' test and experiments with our Type A Valves, under various conditions and applications, a large copper producer has ordered a Type D Valve shipped to Belgian Congo. This application is to a Dorr Tray Thickener 75-ft. diam. by 21-ft. depth. The ground ore from the grinding units (65 mesh), 800 tons per 24 hours, is settled in the thickener. The Type D Valve is mounted on a goose neck, the valve having an effective static head of 16-ft. The valve discharges into a distributor to which is attached the feed launders for the various flotation machines.

The percentage of solids in the flotation feed does not vary any appreciable amount, the re-agents being fed in the desired amount to suit this density, and provide greater efficiency of flotation machines and economy in operation, due to reduction of manual operation.

THYLE MACHINERY COMPANY

129 FREMONT STREET - SAN FRANCISCO, CALIFORNIA

Natural Advantages and friendly cooperation await the manufacturer at New Orleans

PROGRESSIVE manufacturers will find New Orleans a location well adapted for economical and profitable operation of many kinds of industries.

Lying at the gateway of the Mississippi Valley, with ten trunk-line railroads and splendid inland water service making transportation quick and convenient to all parts of the country, and particularly to Mississippi Valley points — distribution problems are easily solved at New Orleans.

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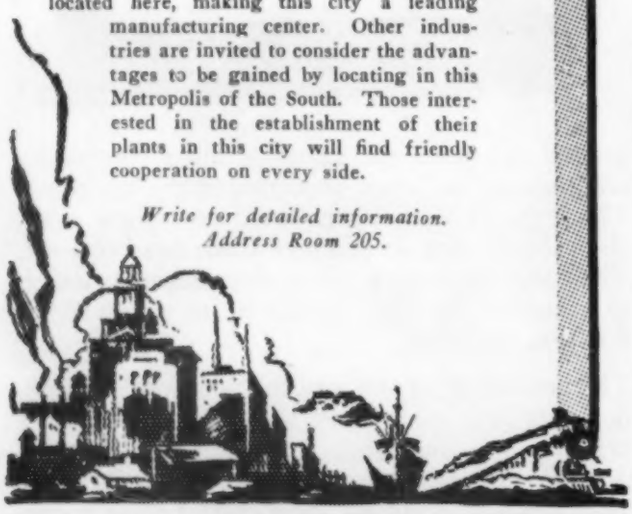
New Orleans is a primary market for important raw materials — cotton, lumber, turpentine and rosin, oils, salt, sulphur, etc. Others may be secured from foreign sources within easy reach of this city.

New Orleans is the financial center of the South, with several of the largest banks in America. This city is amply able to meet all financial needs consistent with good banking.

Twelve hundred factories are already located here, making this city a leading manufacturing center. Other industries are invited to consider the advantages to be gained by locating in this Metropolis of the South. Those interested in the establishment of their plants in this city will find friendly cooperation on every side.

Write for detailed information. Address Room 205.



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In this revision all of the methods have been brought strictly up to date; many of the methods have been expanded; 40 additional methods have been included and a new chapter on Water, Sewage and Soils has been added.

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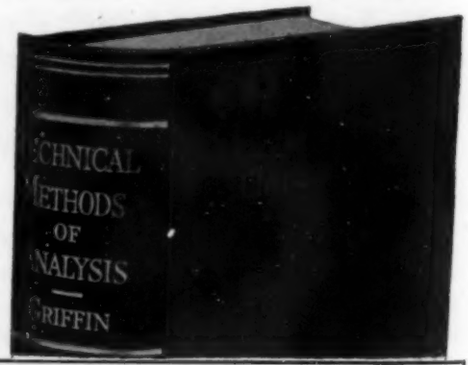

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NOW OPEN—A real position for a chemical engineer for research work entirely. In answering give full qualifications, experience, etc. P-983, Chemical & Metallurgical Engineering, Guardian Bldg., Cleveland, Ohio.

OPERATING MAN from 28 to 35 years of age with some technical training and with considerable experience in plant operation and maintenance work, preferably acids and chemicals. Some experience on light construction work and operation of power plant would be an asset. Applicant should have real ability for handling men efficiently and maintaining plant equipment and quality of product. Good opportunity for right man. Plant located in East on outskirts of large city. Give full information including complete record of training, previous employment, and salary record. P-974, Chemical & Metallurgical Engineering, Tenth Ave. at 36th St., New York.

PATENT department of large chemical corporation has place for thoroughly trained chemist or chemical engineer who is a patent attorney or solicitor. Law degree desirable but not required of man with legal training who can qualify before the patent office. Middle western location. Replies held strictly confidential. P-985, Chemical & Metallurgical Engineering, Tenth Ave. at 36th St., New York.

WE need a capable draftsman experienced in designs and installation plans covering machinery for flour and feed mills, also crushing, grinding, sifting, mixing, elevating and conveying machinery for dry powdered and finely granular chemicals and kindred materials. Experience in sheet metal and structural design desirable. P-976, Chemical & Metallurgical Engineering, 1600 Arch St., Phila., Pa.

An Excellent Opportunity

A large commercial laboratory with a general analytical and consulting business in a growing field requires a graduate chemist of 35 or 40 who has had general industrial experience preferably with some in the metallurgical field.

He will serve as understudy to one of the principals of the business, a chemist of recognized standing, and gradually take over his work.

The position offers wide scope to an ambitious man with sound technical training and experience and a practical and commercial turn of mind. The prospects are particularly favorable.

Give details of training and experience, age, nationality, references, salary required, etc. Confidential.

P-972, Chemical & Metallurgical Engrg.
Tenth Ave. at 36th St., New York City

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YOUNG MAN with chemical knowledge in manufacturing pigment colors. State age, experience, education, references and salary expected. Good opportunity for right party. P-982, Chemical & Metallurgical Engineering, Tenth Ave. at 36th St., New York.

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$3,000.00-$30,000.00 men find our service effective in making connections; individual; confidential; refund agreement; not agency. Jacob Penn, Incorporated, 9 Park Place, New York.

EMPLOYMENT AGENCIES

POSITION open for chemical, metallurgical and consulting engineers, designers and draftsmen. Write Consolidated Agencies, formerly H. H. Harrison, 110 So. Dearborn St., Chicago, Ill.

POSITIONS WANTED

ANALYTICAL chemist, eight years' experience, industrial materials, chemicals, gas, fuel, steel, etc. Thoroughly familiar with rapid analytical methods for quick results. Available immediately. Start $175 month. Age 30, married. PW-979, Chemical & Metallurgical Engineering, 1600 Arch St., Phila., Pa.

CHEMIST, ten years in laboratory and plant operation covering iron, steel, alloys, paints, varnish, gas, coal byproducts and superintendent water filtration plant; sales work considered; locate anywhere. PW-987, Chemical and Metallurgical Engineering, 7 South Dearborn St., Chicago, Ill.

CHEMIST—Cellulose and introcellulose, 10 years' experience, desires research or experimental work along similar or related lines with progressive concern. At present employed. PW-981, Chemical & Metallurgical Engineering, Tenth Ave. at 36th St., New York.

POSITION VACANT

Lacquer Chemist

for research and development work. Should be graduate chemist, with some experience with Pyroxylin Lacquers and Solvents. Location in Middle West. Give full details of training and qualifications.

P-978, Chemical & Metallurgical Engrg.
Guardian Bldg., Cleveland, Ohio

POSITIONS WANTED

CHEMICAL engineer with 3 years plant and laboratory experience as asphalt paving chemist and control chemist on byproduct coke oven plant, with one year's sales experience, desires promising position. PW-986, Chemical and Metallurgical Engineering, Tenth Ave. at 36th St., New York.

CHEMICAL engineer. Age 29. College graduate. Seven years with large corporation. Excellent record. Good analyst. Experience with alkali salts and process development. Accept almost anything with good future. PW-948, Chemical & Metallurgical Engineering, 1600 Arch St., Philadelphia, Pa.

INORGANIC chemist, thoroughly experienced with the general inorganic industry and also partly acquainted with the metallurgy wishes to increase his knowledge in metallurgy of the non-ferrous metals. Willing to accept a position at a moderate renumeration. PW-978, Chemical & Metallurgical Engineering, Tenth Ave. at 36th St., New York.

MECHANICAL engineer, 34, with eleven years' experience in plant design, construction, operation and maintenance, desires a change which offers greater usefulness. Have an excellent record of real accomplishment in the development of methods and processes for reducing operating costs. PW-925 Chemical & Metallurgical Engineering, 1600 Arch St., Phila., Pa.

POSITION wanted as chemical director or production manager; Cornell graduate; experienced in directing chemical research and control; in the development of new plant processes; in cost reduction, and large scale production. PW-941, Chemical and Metallurgical Engineering, Tenth Ave. at 36th St., New York.

EXECUTIVE, American, 35, Cornell chemist, combining managerial capacity, sales ability and a very extensive technical experience in chemical and several allied industries, desires to change to responsible position such as developmental director, assistant to president, etc. Wide patent experience, linguist, very high references. PW-965, Chemical and Metallurgical Engineering, Tenth Ave. at 36th St., New York.

EXECUTIVE CHEMIST, Ph.D.; 18 years' varied research development, production and business experience; formerly also with Bureau of Standards; seeks permanent engagement requiring special qualifications for executive ability and high technical proficiency combined with understanding of commercial aspects involved; highest references. PW-984, Chemical & Metallurgical Engineering, Tenth Ave. at 36th Street, New York.

INDUSTRIAL chemical engineer, eleven years' experience manufacture, chemical control, development in phosphoric acid, phosphates, sulfuric acid, synthetic ammonia, fertilizers, insecticides, textiles, heavy chemicals and other lines. Can handle men, laboratory work, plant research. Specialty improving yield, quality, reducing costs, development. Executive ability proven. PW-955, Chemical and Metallurgical Engineering, Tenth Ave. at 36th Street, New York.

Control Chemist, Manufacturing Superintendent

Production Engineer. Experienced cotton textile finishing, pulp products, deturgents, molded insulation, other lines. Age 43. Present connection restricted subsidiary. Want change. Will locate in city or country, Middle West or East.

PW-966, Chemical & Metallurgical Engineering,
883 Mission St., San Francisco, Cal.

POSITION WANTED

SALES manager, sales engineer or plant manager. During eighteen years' operating and selling experience, chemicals and process machinery I have made good in all of the above positions. I am a chemical engineer, 39 years old and I am well known in the chemical equipment field and considered an authority on corrosion resisting machinery. I am interested in either an operating or sales position. PW-962, Chemical and Metallurgical Engineering, Tenth Ave. at 36th Street, New York.

SALESMAN AVAILABLE

SALESMAN, chemical engineer with six years' experience in sales and development work and four years' previous practical plant experience, desires sales position with high grade chemical or chemical equipment concern offering large opportunities for growth. Thoroughly acquainted in sales capacity in Eastern territory. SA-980, Chemical & Metallurgical Engineering, Tenth Ave. at 36th St., New York.

BUSINESS OPPORTUNITY

Exceptional Opportunity

Will invest equally, with experienced party, a substantial amount in new business, or extension of your present business, to be established in idle factory. Plant readily adapted for food products, chemicals, or specialty manufacture. State proposition fully. BO-977, Chemical & Metallurgical Engineering, Guardian Bldg., Cleveland, Ohio.

MISCELLANEOUS

Wanted Chemical Processes

Practical, economical chemical processes with necessary drawings. M-970, Chemical & Metallurgical Engineering, Guardian Bldg., Cleveland, Ohio.

Laboratory Equipment

Wanted for steel analysis to determine chemical and physical properties, also hardness. In submitting list give name of manufacture, length of service, lowest possible price. M-975, Chemical & Metallurgical Engineering, 1600 Arch St., Phila., Pa.

FREE BULLETINS

GREGORY ELECTRIC CO., 16th and Lincoln Sts., Chicago, Ill.—The November issue of this company's Monthly Bargain Sheet of Hi-grade rebuilt motors and electrical machinery has just been issued. A special announcement accompanying this booklet states that "this issue contains the most complete and drastic downward revision of prices in our history."

PETROLEUM CHEMICAL CORP. PLANT, TIVERTON, RHODE-ISLAND

For Sale

This Plant has a water frontage of approximately 1000 feet; Railroad facilities; about thirty acres of land; Power House with 450 H.P. capacity; fresh and salt water system. All buildings in first class condition.

We desire to sell the Plant in its entirety.

Anyone desiring to inspect Plant same can be arranged by writing to Samuel J. Smith, c/o Petroleum Chemical Corporation, P. O. Box 1007, Peoria, Illinois.

Sales Agent or Manufacturers Representative

A large manufacturing company with National Distribution of its products, accomplished by direct and jobber representation, is in position to promote sales of heavy, semi-heavy and fine chemicals. Inquiries are solicited from manufacturers who wish to enlarge their markets or to open new territories.

AS-952, Chemical & Metallurgical Engrg.
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Specialists in

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The service and advice of Chemical engineers with extensive plant experience is available to executives in aiding them to locate suitable factories.

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Excellent locations with low labor costs. Industrial Plants of all kinds with or without equipment for sale or lease. Free industrial sites to responsible manufacturers, with buildings erected and financed "Where shall we locate our factories?" sent free on request.

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Back issues of Chemical & Metallurgical Engineering and other Chemical and Scientific Magazines, as well as complete files in stock. Will be pleased to quote our prices.
We buy unbound and bound Scientific Periodicals.

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29 East 21st St., New York

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We will supply you with Tantalite.
What are your requirements?
We will contract to supply
any amount you may require.

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Savoy South Dakota

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Because, (1) We have the largest stock on hand.

(2) We are the only used machinery dealers in this part of the country, with extensive machine shop facilities to overhaul, rebuild and test out all our offerings.

Frankly, we like to have our customers shop around—compare values. Comparisons are the safety spots that protect your pocketbook and—SHOW THE VALUE OF CONSOLIDATED OFFERINGS.

To save time, visit our extensive Warehouse at Doremus Avenue, Newark, N. J. FIRST. Observe the steady production of overhauled, rebuilt equipment in the shops, and the excellent condition of machinery being shipped daily at our railroad siding. Then, if you still feel the desire to look at other offerings, you can carry CONSOLIDATED PRODUCT VALUES as a standard upon which to base your decision.

We are in the market for your idle and surplus machinery. Send us your list FIRST.

AUTOCLAVES

6—Laboratory Autoclaves.
2—250 gal. Jacketed, Agitated.
1—1200 gal. Jacketed.
4—3800 gal. New.

DRYERS—TRUCK & TRAY

1—Proctor Tunnel Dryer.
2—Proctor 2 Truck Dryers.
1—8 Truck Hurricane Dryer, 2400 sq.ft. drying surface.
1—Gordon Shelf, 800 sq.ft.
1—Proctor Truck, 800 sq.ft.

DRYERS—VACUUM SHELF—DEVINE

10—No. 12; 4—No. 23; 6—No. 25; 2—No. 27; 5—No. 34, brand new, complete with Pumps and Condensers; 3—No. 58.

DRYERS—VACUUM SHELF—BUFFALO FOUNDRY

6—J 20 complete with Pump and Condensers.
1—19 Shelf 60-in.x120-ft.

DRYERS—ROTARY VACUUM

1—Devine 3x15-ft.
1—Stokes 4x15-ft.
1—Devine 3x25-ft.

DRYERS—DRUM

1—4x6-ft. Stokes Atmospheric.
1—4x8-ft. Perrin Atmospheric.
2—4x9-ft. Double Drum Atmospheric.
4—4-ft. 6-in.x12-ft. Rotary Drum Atmospheric.

EVAPORATORS

2—Swenson Single and Double Effect, 250 sq.ft.
1—Stokes Triple Effect, 1000 sq.ft.
1—Scott Triple Effect, 1350 sq.ft.
2—Swenson Triple Effect, 1—1750 sq.ft. and 1—3200 sq.ft.

CENTRIFUGALS, BELTED, MOTOR DRIVEN, COPPER AND STEEL BASKETS

3—48-in. Tolhursts.
9—48-in. Fletcher (S. & U.).
6—40-in. Tolhurst.
21—20-in. to 36-in. Tolhurst, American Laundry, Troy, Etc.

CENTRIFUGALS—STEAM DRIVEN

4—48-in. Fletcher.
1—40-in. Tolhurst.
1—40-in. Fletcher.
1—30-in. Fletcher.

FILTER PRESSES—IRON & WOOD, OPEN & CLOSED DELIVERY, RECESSED, PLATE & FRAME

1—Shriver 42x42-in.
1—Shriver, 36x36-in.
1—Johnson 36-in.
10—Shriver 30x30-in.
2—Sperry 30x30-in.
2—Johnson 24x24-in.
2—Shriver 18x18-in.
1—Shriver 18x18-in., lead.
1—Shriver, 12x12-in.

DRYERS—DIRECT HEAT

1—5x36-ft. American Rotary.
1—5x24-ft. Allis-Chalmers Rotary.
4—4x30-ft. American Rotary.

SWEETLAND FILTERS

4—No. 12; 1—No. 11; 1—No. 10; 2—No. 7; 2—No. 5; 1—No. 2.
1—Laboratory Clamshell.

OLIVER FILTERS

3—6x4, all iron.
2—6x6, Wood Staves.
2—6x6, Acid proof, one new.

WERNER & PFLEIDERER MIXERS

1—Size 14, Jacketed, 50 gal.
5—Size 15, Jacketed, 100 gal.
1—Size 15, Unjacketed, 100 gal.
1—Size 16, Jacketed, 150 gal.
2—Size 16, Unjacketed, 150 gal.
2—Size 17, Jacketed, 200 gal.
1—Size 18, Jacketed, 240 gal.
1—Size 18, Unjacketed, 240 gal.
1—Size 30, Jacketed, 2300 gal.

MIXERS

1—1000 gal. Day, Jacketed.
1—550 gal. Day, Jacketed.
3—500 gal. Stokes, Jacketed, Dough.
2—500 gal. Day, Jacketed, Jumbo.
6—6 bbl. B & S, Dough.
3—100 gal. Day, Dough.
2—100 gal. Day Imperial.
3—60 gal. Day, No. 30 Imperial, Jacketed.
2—50 gal. Day, Dough.
25—Sizes A, B, C, & D, Day Sifters and Mixers.

GRINDERS

10—Schutz O'Neil Mills, 16-in.; 20-in.; 22-in.; 28-in.
12—Meade Mills Nos. 1-2-3.
9—Raymond Mills, No. 1, No. 0, No. 00, No. 000, No. 0000.
8—Raymond Mills, 4-roll low side and 4-roll high side.
1—Raymond Mill, 5-roll, high side.

CRUSHERS

2—Williams Corrugated Rolls 6x18.
1—Williams Hammer Mill, No. 2.
1—Williams No. 5 Roller Knife Shredder.
3—Williams Infant Mills.
2—Allis-Chalmers Roll Crusher, 24x14-in.
1—Sturtevant Jaw Crusher, 8x10.
1—Sturtevant Duplex Jaw Crusher, 6x15.
1—Champion Jaw Crusher, 9x15.
1—Kite Jaw Crusher, 7x16.

PEBBLE MILLS

1—Abbe, Silex Lined, 15x18.
1—Abbe Unlined, 30x36.
1—Day, Steel Lined, 30x36.
1—Day, Steel Lined, 36x42.
1—Patterson, Silex Lined, 4x5-ft.
4—Alsing, 6x5-ft. Silex Lined.
1—Abbe, Silex Lined, 7-ft. 6-in. 10-ft. arranged for continuous feed and discharge.
4—Allis-Chalmers, 6x5, Steel Lined, continuous feed and discharge.

HARDINGE MILLS

2—Hardinge Mills, 4½-ft.x16-in.
1—5-ft.x22-in., Hardinge Mill.
2—6-ft.x22-in., Hardinge Mills.
2—8-ft.x36-in., Hardinge Mills.
1—8-ft.x30-in., Hardinge Mill.
1—8-ft.x48-in., Hardinge Mill.

KETTLES—JACKETED, OPEN

20—40 to 100 gal. Cast Iron.
16—125 gal. Cast Iron.
21—200 and 250 gal. Steel.

KETTLES—JACKETED, AGITATED, OPEN

8—50 and 85 gal. Dopp Cast Iron.
3—50 gal. Steel.
20—100 and 150 gal. Dopp.
6—150 gal. Devine.
1—175 gal. Dopp.
10—300 gal. Cast Iron.
3—700 gal. Steel.

KETTLES—CLOSED AGITATED, NITRATORS, SULPHONATORS

1—110 gal. S & P Cast Iron.
14—150, 175, 250 gals. Cast Iron.
2—500 gal. Duriron.
1—700 gal. Steel.
4—900 gal. & 1000 gal. Cast Iron.
1—2000 gal. Closed, Steam Jacketed, Agitated.
2—1200 gal. Closed, Steam Jacketed, Agitated.

KETTLES—ALUMINUM, DURIRON, COPPER, ENAMEL LINED

1—300 gal. Duriron, Jacketed, Agitated, closed top.
2—80, 60, 40 gals. Aluminum, Jacketed.
12—50, 20, 10 gals. Enameled, Jacketed.
10—375, 250, 200 gals. Copper, Jacketed.
12—150, 80, 50 gals. Copper, Jacketed.

DISTILLING UNITS

1—Lummus 12-in. Copper Column with Deph. and Condenser.
1—Lummus 24-in. Copper Column with Deph. and Condenser.
1—30-in. Badger Copper Column, 20-ft. high bell type, complete.
1—Lummus 36-in. Copper Column with Deph. and Condenser.
1—Lummus 36-in. Steel Column with Condenser.
1—60-in. Vulcan Column with Deph. and Condenser.

REDUCER

1—1600 gal. Buffalo (New).

TANK BARGAINS

8—6x24-ft. Steel Tanks.
3—8x40-ft. Steel Tanks.
25—50 to 20,000 gal. Steel Tanks.

VACUUM PANS

10—Copper, 25 gal. to 600 gal.
1—6-ft. Copper Vacuum Pan.
1—7-ft. Cast Iron Vacuum Pan.

SULPHUR BURNERS

1—Glens Falls Sulphur Burners 3-ft.x8-ft., complete.
4—Glens Falls Sulphur Burners, 4-ft.x16-ft. complete.
2—Glens Falls Sulphur Burners, 4-ft.x20-ft.

SPECIAL

5—100 gallon Steam Jacketed Day Imperial Mixers

Consolidated Products Company, Inc.

15 Park Row — New York, N. Y.

Phone: Barclay 0603, 0605.

Cable Code: Equipment
Bentley and ABC—6th Edition

BLOWERS

Nash—No. 1, with 10 hp. motors.
Beach Russ No. 3, 2, 7.
Sirrocco—Buffalo—Sturtevant, many sizes.

BUCKET ELEVATORS

Many sizes, steel encased.

COMPRESSORS

Ingersoll-Rand—Worthington—Sullivan
I.R. 210 ft. Portable 4 cyl. gasoline engine, 8x8 — 7x7 Duplex.
9x9x8—10x12x12. 6x6
10x12x14 Duplex. 9x8
14x12x12 Duplex. 14x14
16x16x18 Duplex. 18¼x14
12x14x18 Duplex.

CRUSHING ROLLS

24x20—14x24—16x36—30x12, 28x16.

DRYERS

1—6x6-ft. Calciner.
1—6-ft.x100-ft. Rotary.
1—3x10.
3x25-ft. Rotary 3x24 indirect.
Stokes Laboratory.
3x10 Aluminum lined indirect.
5x33-ft. Devine Rotary Vacuum.

CENTRIFUGAL PUMPS

Many Sizes and Heads
Duriron, 1½ in. and 2 in.—Lead—Bronze

2-in., motor driven.
3-in., motor driven.
3-in., 200 g.p.m., 38-ft. head, motor driven.
5-in., motor driven.
12-in., 3 stage, motor driven.
8-in., 2700 g.p.m., 75-ft. head.
8-in., 2500 g.p.m., 65-ft. head.
8-in., 1000 g.p.m., 100-ft. head.
2-stage, 1800 g.p.m., 500-ft. head, Steam Turbine Driven.
2-stage, 1000 g.p.m., 260-ft. hd.

FEED WATER HEATERS

1—Cochrane 500 hp., open type.
1—Cochrane 300-hp., open type.

FILTERS

Zenith—6x8-ft.
American continuous complete unit. 12 leaves, 6-ft. dia.
Sweetland—Nos. 4 and 9.

MILLS

Abbe—Patterson—Aacone (Pebble)
3—Patterson 4x5.
2—7x10-ft. 2—6x7-ft. 3—6x8.
8-ft.x48-in. Hdge. latest type ball.
5x22-in. Hardinge Pebble.
1—6-in.x48-in. Hardinge Ball.
3—Stearns-Roger 5 ft. 6 in. x 22 ft.

MISCELLANEOUS

22-in. and 28-in. Shutz O'Neill.
30-in. Ross Burr Stone.

HYDRAULIC PRESSES

1—350 T. pump and accumulator.
1—250 T. pump and accumulator.
24x24-in. with pump and accum.

PUMPS

12x6½x12 Amer. Bronze fitted. 250 lbs. pressure.
5x7½x10 Amer. Bronze fitted, 80 lbs.
Triplex 3x6. Duplex 8x10.

TANKS AND POTS

Steel, Cast Iron, Wood, Many Sizes, Some New, Some Lead Lined
200,000 Steel on 100-ft. Tower.

VACUUM PUMPS

Devine—Ing.-Rand—American.
4½x5. 5x4.
22x8-in. 6½x8x10 Wet.
6x8½x12. 8-in.x22-in.
6x8. 10x9.

KETTLES, JACKETED AND AGITATED

Dopp 1 gallon.
Mott 25-50-75 gallon.
Devine 150-1,000-2,000 gallon.
Fusion Kettle 3 ft. dia. x 4 ft. rake stirred gas or oil fired.
Fusion Kettle 6 ft. dia. x 3 ft.

MISCELLANEOUS

Coal Loaders.
Electric Hoists.
Ammonia Receivers and Cooling Coils.
Tycos Heat Controls and Recorders (New).
Merco Cocks 3-in. new.
Oil-fired Lead Melting Pot.
Dust Collectors.
35 hp. Erie Economic Boiler
60 hp. Erie Vertical Boiler.
100—Furnace Doors and Frames
Mixers change can.
Testing Machine, Riehle.
Furnaces—U. S. Melting No. 4 oil fired.
Centrifuge—36-in. copper basket.
Emulsifier—60 gallon.

Horatio Held the Bridge

and because of his valor won a place among the lone hand fighters of all time

Lawler has been holding the bridge of integrity in the field of used chemical equipment for more than twenty years. Nothing crosses it but transactions that bear the stamp of our positive guarantee.

We know that our success is built on our ability to hold customers—to bring you back for another unit and a heavy cash saving because of the profitable buy you made on the occasion of your last purchase. This partial listing of our warehouse stock is an indication of the wide variety from which we can meet your replacement requirements.

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FILTER PRESSES

Devine 24 and 30 in. C.I.
Sperry 30-in.
Shriver 18 in. and 24 in. wood.
Patterson 72 leaf 28 in. C.I.
Patterson 12 in. and 15 in. C.I.

GRINDING PLANT

2—42-in. Fuller Mills—Cummer Dryer Elevators, Conveyors, Bins, etc.

EVAPORATORS

1—Devine 36-in., with salt chamber, a complete unit.
Stokes double effect, 250 gallons per hour, 24-in. with salt chamber.

CRUSHERS

20x10, 24x12, 9x14, 7x24, 16x9, 6x9, 36x48.

MACHINERY BARGAINS
FOR SALE

Autoclaves

5—Experimental Autoclaves, 1 to 3 gals.
2—40-gallon Steel Autoclaves.
1—80-gallon Steel Autoclave.
1—150-gallon Jacketed Autoclave with Agitator.

Mixers

12—Horizontal Mixers, 25 to 40 gals.
2—900-gal. Horizontal Steel Mixers.
2—20-gal. Experimental Kettles.
1—50-gal. Experimental Mixer Kettle.
1—100-gal. Jacketed Mixer Kettle.
2—150-gal. Jacketed Valleiron Mixers.
1—200-gal. Jacketed Pfaudler Mixer.
1—500-gal. C.I. Jacketed Sulphonator.
5—1,500-gal. C.I. Reduction Kettles.
7—1,600-gal. Jacketed Nitrators.
150—"Wear-Ever" Aluminum Jacketed Kettles, 40, 60 and 80 gals. capacity.
3—15-gal. Jacketed Copper Kettles.
14—60 and 80-gal. Jacketed Copper Kettles.
2—120-gal. Copper Kettles.
2—40-gal Enameled Jacketed Pans.

Filters

1—30-in. Johnson C.I. Filter Press.
18—30-in. sq. Wooden Filter Presses.
5—24-in. sq. Wooden Filter Presses.
2—24-in. sq. Cast Iron Filter Presses.
3—18-in. sq. Wooden Filter Presses.
1—30-in. dia. Steel Pressure Filter.
20—30-in. Filter Press Skeletons.

Distilling Apparatus

2—75 gal. Jacketed Copper Stills.
1—100-gal. C.I. Mixing Still.
4—115-gal. Aluminum Jacketed Stills.
4—Steel Stills, 150 to 2,000 gals.
1—900 gal. Heavy Copper Still.
6—Copper Columns 15 in., 18 in., 24 in. diam.
3—Dephlegmators, 15 in. and 18 in.
13—Condensers, Assorted.

Evaporators

1—Devine Vacuum Evaporator.
4—Jacketed Evaporating Pans, 7 ft. dia. x 30 in. deep.
2—Zaremba Evaporators, 5 ft. diam.
2—Evaporating Pans, 8 ft. dia. x 3 ft.

Vacuum Pumps

20—Beach Russ Rotary Vacuum.
2—Devine, 4x6 in.
1—Stokes, 2-stage 6x3 in.
1—Devine, 5x10x8.
1—Blaisdell, 14x10 in.; belted.
1—Alberger, 8x16x10.
1—Pennsylvania 14x5 in.

Mills and Grinders

1—Hardinge Conical Ball Mill, 24 in. dia.
5—Abbe Mills, 24x30 in., 4x5 ft.
1—Allis-Chalmers Rotary Hammermill.
1—Jeffrey Spike Roll Coal Crusher.
1—Gruendler Rotary Hammer Mill XXXX.
2—Ross Paint Mills 20 in. diam.

MACHINERY & EQUIPMENT CO., INC.

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What Do You Manufacture?

Whatever you may manufacture in Chemicals, Acids or any of the kindred industries, there is equipment at Old Hickory that will be of service to you and which will give you unlimited service at low cost. From the Government's largest wartime operation, there still remains a vast amount of good used equipment that can save thousands of dollars for the chemical industries. In the past seven years Old Hickory has saved buyers of equipment more than $3,000,000—the difference between the cost of new and used equipment. Some of the items now available:

STEEL TANKS

Quantity	Size Diameter	Height	Cap. in Gallons
10	2 ft. 6 in.	3 ft. 3 in.	119
1	3 ft.	8 ft.	425
1	4 ft.	5 ft. 5 in.	510
1	2 ft. 6 in.	3 ft.	100
1	6 ft.	6 ft. 10 in.	1,445
2	7 ft.	4 ft.	1,152
2	4 ft. 3 in.	4 ft. 10 in.	510
1	4 ft. 6 in.	8 ft.	950
20	4 ft. 6 in.	24 ft.	2,855
2	5 ft.	4 ft.	590
1	6 ft.	4 ft. 9 in.	1,000
4	6 ft.	11 ft. 5 in.	1,260
1	6 ft.	24 ft.	5,120
7	7 ft. 6 in.	7 ft. 10 in.	2,340
30	8 ft.	6 ft.	2,256
12	9 ft. 6 in.	9 ft. 6 in.	5,120
1	16 ft.	10 ft. 6 in.	15,000
7	20 ft.	12 ft.	28,200
1	3 ft.	9 ft. 6 in.	525
1	4 ft. 4 in.	7 ft. 3 in.	1,000
2	4 ft. 4 in.	8 ft. 6 in.	950
1	5 ft.	9 ft. 8 in.	1,500
1	5 ft.	12 ft.	1,800
1	5 ft.	18 ft.	2,750
1	3 ft.	6 ft.	325
1	3 ft.	6 ft.	325
3	5 ft.	4 ft.	590
1	5 ft.	10 ft.	1,500
1	5 ft.	7 ft. 3 in.	1,100
1	5 ft. 6 in.	6 ft.	1,250
1	5 ft. 6 in.	5 ft. 6 in.	1,000
1	6 ft. 4 in.	3 ft. 6 in.	862
1	6 ft. 4 in.	4 ft.	1,000
1	6 ft. 4 in.	10 ft. 6 in.	2,200
1	6 ft. 4 in.	11 ft. 6 in.	2,500
1	6 ft. 4 in.	12 ft.	2,700
1	6 ft. 4 in.	13 ft. 6 in.	3,000
2	6 ft. 4 in.	14 ft.	3,250
6	7 ft.	11 ft.	3,100
1	7 ft. 11 in.	2 ft. 6 in.	950
1	10 ft.	8 ft.	4,700
3	7 ft.	30 ft.	8,200
4	21 ft. 6 in.	7 ft. 9 in.	22,000
1	21 ft. 6 in.	16 ft. 2 in.	44,000
4	21 ft. 6 in.	15 ft. 6 in.	43,000
1	30 ft.	16 ft. 2 in.	85,000

Sketches and detailed specifications available.

CAST IRON POTS

1—Cast Iron Autoclave, 25x32 in., 3 in. walls, 60 gallons capacity.
16—Buffalo Cast Iron Reducers, 6 ft. 4 in x 8 ft., 2,000 gallons capacity.
1—Cast Iron Beta-Naphtha Still, 5x6 ft., 1,000 gallons capacity, with two 2 ft. 6 in. x 5 ft. cast iron receivers.
1—Cast Iron Blow Off Pot, 4x4 ft., 435 gallons capacity.
6—Cast Iron Pots, with covers, 5 ft. x 4 ft. 8 in., 900 gallons capacity.
1—Cast Iron Nitrator, 4 ft. x 6 ft. 6 in., with agitator and steam jacket, 700 gallons capacity.
8—Cast Iron Nitrators, 6 ft. x 10 ft. 6 in., steam jacketed, 2,200 gallons capacity.
2—Cast Iron Acid Eggs, 4x6 ft., 550 gallons capacity.
2—Cast Iron Acid Eggs, 4x8 ft., 750 gallons capacity.

AUTOCLAVES

3—Kellogg hammer welded steel Autoclaves, 3 ft. x 10 ft. 3 in., 500 gallons capacity, 300 lbs. pressure.

EXTRACTOR

1—30 in. Extractor, overhung type. Steel Basket 30 in. dia. x 14 in. deep, bottom dump type.

CRYSTALLIZING PANS

3—Steel Plate Jacketed Crystallizing Pans, 6 ft. dia. x 2 ft. deep, ⅝ in. plate 6 ft. dia. x 14 in. deep, ⅝ in. plate. Overflow trough, spout and agitator.

FILTER PRESSES

2—30x30 in. Filter Presses, wood frames and plates.

BURR MILLS

3—Samuel Carey Self-Tramming Geared Burr Mills.

Just Released—

COMPLETE COAL CARBONIZATION PLANT WITH RETORTS, OIL STILLS, TAR RECOVERY PLANT, COAL HANDLING AND CRUSHING EQUIPMENT, BRIQUETTING AND MIXING MACHINERY, GAS PRODUCERS, AND POWER PLANT. NEW LISTS READY JANUARY FIRST

DISINTEGRATOR

1—Holmes & Blanchard "Improved" Disintegrator, size 36 in. steel breaker and four rows breaking pins.

ROTARY KILN

1—Vulcan Rotary Kiln, 7 ft. 6 in. dia., 80 ft. long. All complete with drive mechanism and furnace.

TUBE MILLS

1—F. L. Smidth Tube Mill, 48 in. dia. x 10 ft.; lined with 3 in. Silex blocks.
1—Allis-Chalmers Tube Mill, 54 in. dia. x 12 ft. 6 in.; lined with Adamant Silica tube mill lining blocks.

VATS

25—Cypress Vats, 15 ft. long, 5 ft. 10¾ in. wide, 2 ft. 1 in. deep (inside) 2 in. cypress held by through bolts. No exposed metal inside vats. Cap. 1,350 gals.

GRAINERS

5—F. J. Stokes Grainers, cast iron trough, 5x3x4 ft. with steel, steam or water jacket. Sigma blades, pulley and gear drive.

PEBBLE MILLS

3—Pebble Mills, 36 in. dia., 42 in. long mounted on 2½ in. steel shaft with bearings. Shell of drum, ¼-in. plate.

LIME HYDRATOR

1—J. P. Devine continuous Lime Hydrator, practically new.

STILL POTS

1—Steel Still Pot, 5x7 ft., ½ in. plate shell, with 44 turns 2 in. pipe coil.
1—Steel Still Pot, 3x6 ft., ⅜ in. plate shell, with 10 turns 1½ in. pipe coil.
2—Steel Still Pots, 8x8 ft., ¼ in. plate shell, with 18 turns 1½ in. pipe coil.

WATER HEATERS

14—Whitlock Type K Storage Heaters, size 3 ft. 6 in. x 12 ft., 1,000 gallons capacity.
12—Whitlock Type K Storage Heaters, size 3 ft. 6 in. x 14 ft., 2,000 gallons capacity.
7—Whitlock Type A Instantaneous Heaters, size 00, capacity 120 gallons per hour.
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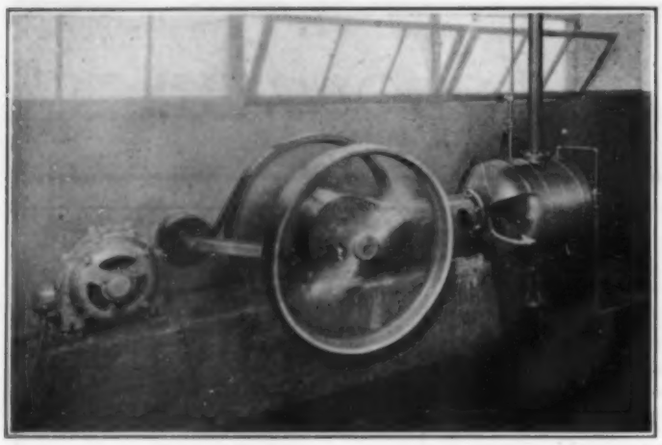

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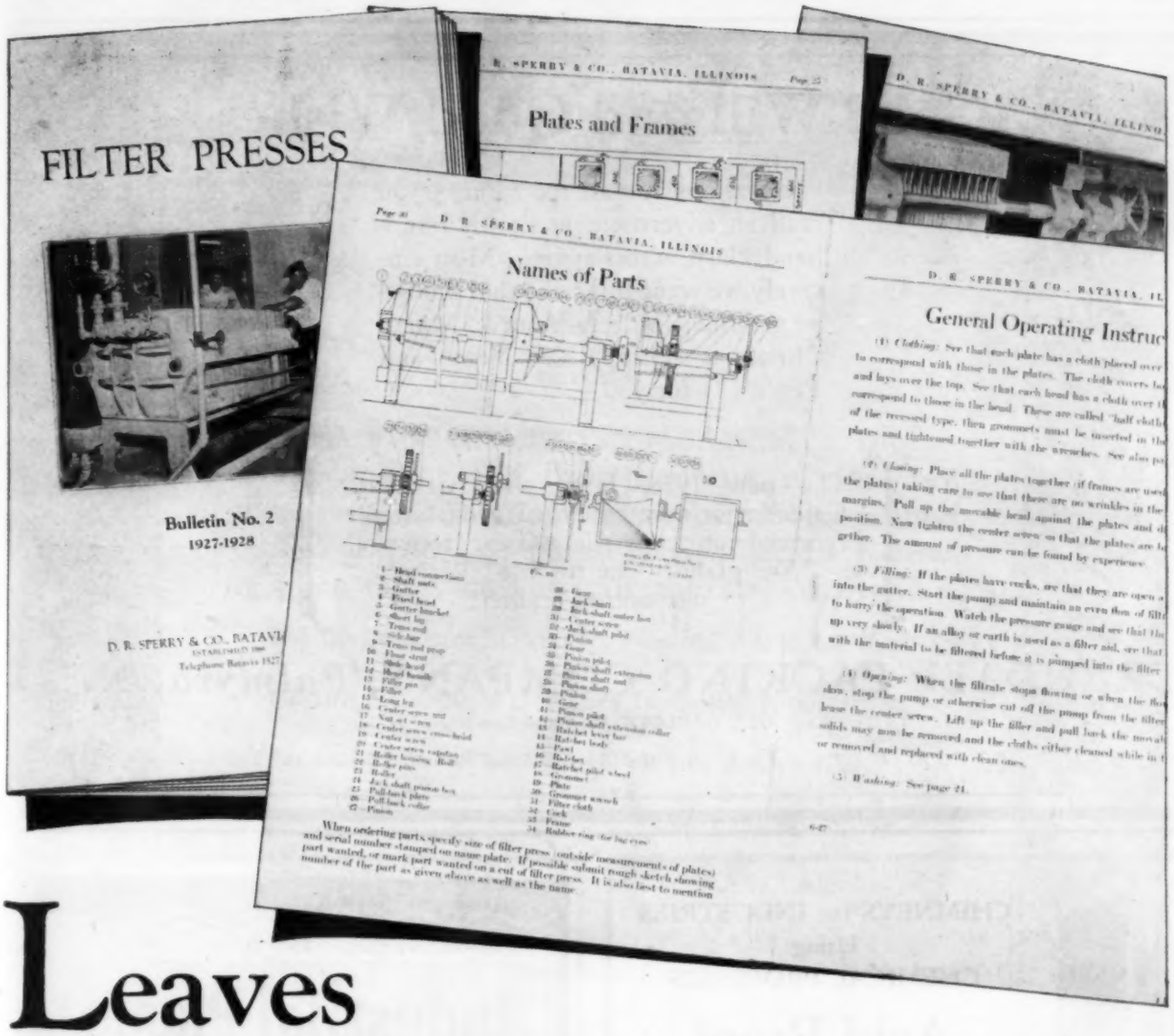

Leaves
from the FILTRATION "HANDBOOK"

—As the Sperry Bulletin No. 2 has come to be called, suggest briefly the valuable character of the information contained in this book. Notice particularly the chart appearing on page 2 which explains the use of all filters in general—also note on 3, the reference to the "Filtration Testing Laboratory"—For it should be remembered that every filter press manufactured by this company to filter certain material is *designed* to meet the exact requirements of the situation as *determined by thorough testing in our laboratory.* Thus we can build presses that we *know* will deliver the desired quantity and meet all the other requirements of the particular case.

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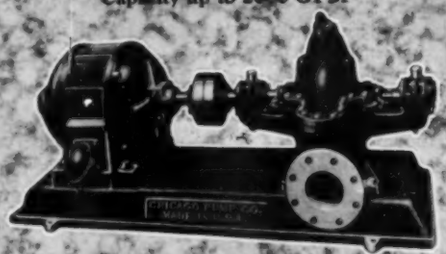

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$CH_3.\ CH\ OH.\ C_3H_7$

Diethyl Carbinol (Secondary Amyl Alcohol)
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$C_2H_5.\ CH\ OH.\ C_2H_5$

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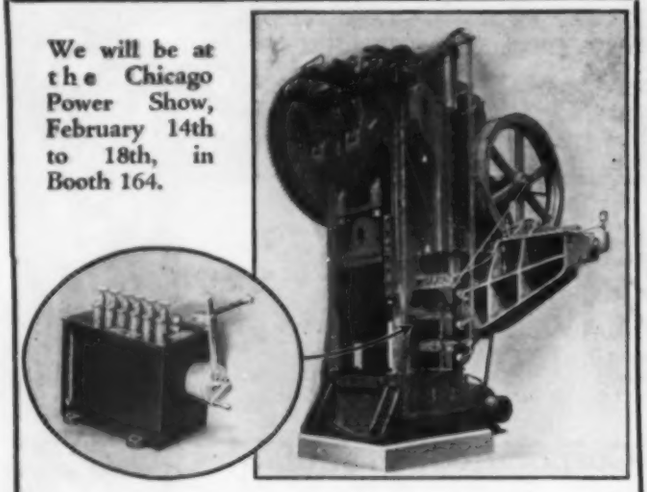

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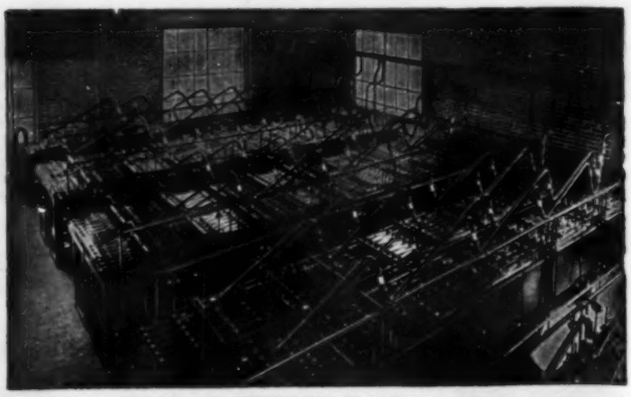

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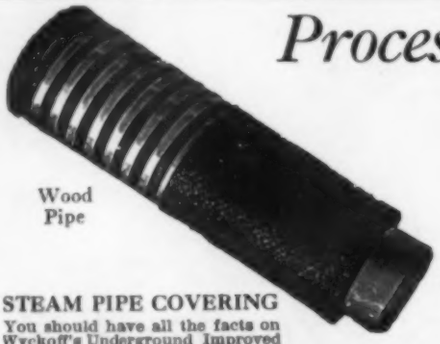

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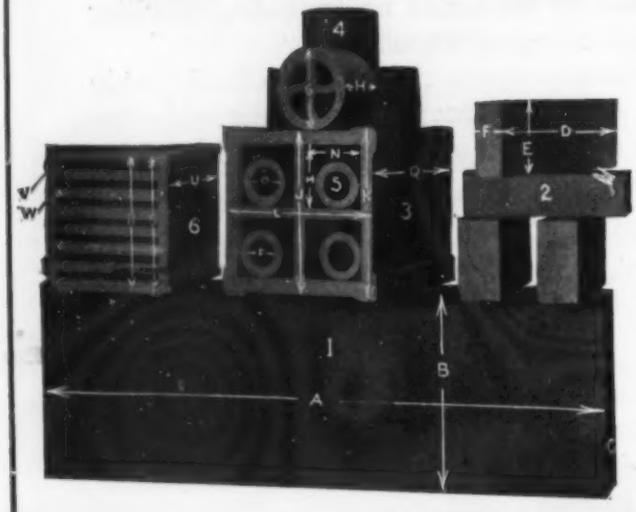

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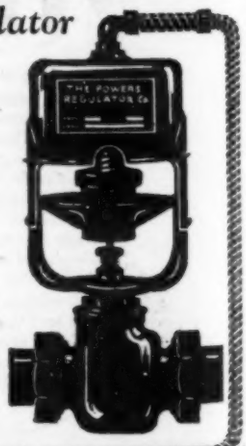

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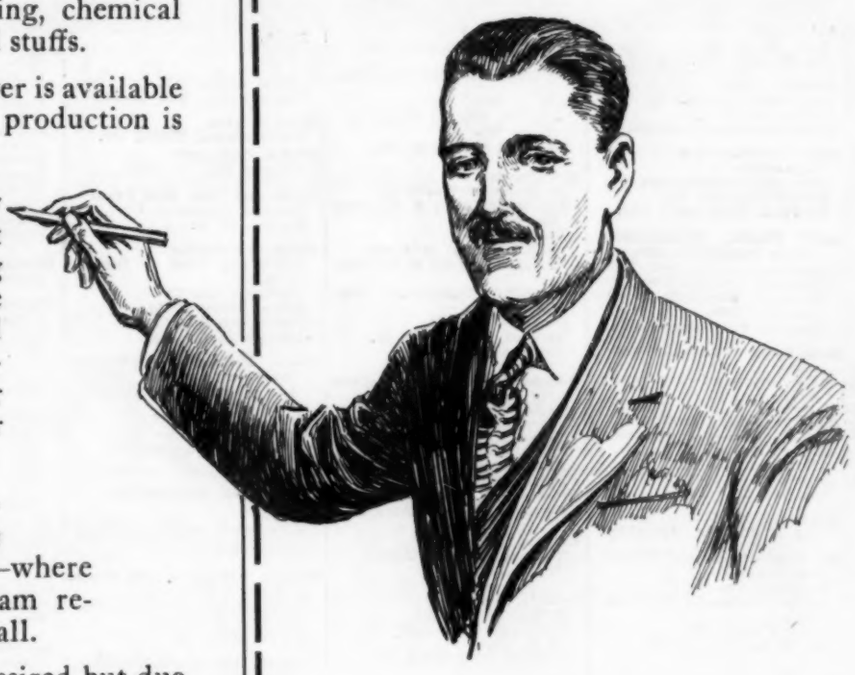

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International Oxygen Co.
Oxweld Acetylene Co.

Cylinders for High Pressure Gases
Biggs Boiler Works Co.
Blaw-Knox Co.
Smith Corp., A. O.

Designing Engineers, Chemical Plant
Chemical Appliances, Inc.

Dewaterers
Thyle Machinery Co.

Diacetone Alcohol
Commercial Solvents Corp.

Disintegrators
Bartlett & Snow Co.
Gruendler Pat. Crusher & Pulv. Co.
Jeffrey Mfg. Co.
Williams Pat. Crusher & Pulv. Co.

Distilling Machinery & App.
Corning Glass Works
Devine Co., J. P.
Wheeler Mfg. Co.

Drives, Chain
(See Transmission Equipment)

Dryers, Centrifugal
American Tool & Machine Co.
Fletcher Works
Sturtevant Co., B. F.
Swenson Evaporator Co.
Tolhurst Machine Works

Drying Machinery and Equipment, Drum, Rotary, Vacuum
Bartlett & Snow Co., C. O.
Biggs Boiler Works Co.
Blaw-Knox Co.
Buffalo Fdry. & Mch. Co.
Devine Co., J. P.
Douthitt Engineering Co.
Duff Patents Co.
Fuller Lehigh Co.
Fulton Sylphon Co.
Nichols Copper Co.
Phila. Drying Mach. Co.
Proctor & Schwartz, Inc.
Ruggles-Coles Division of the Hardinge Co.
Scott & Co., Ernest
Shriver & Co., T.
Stokes Machine Co., F. J.
Sturtevant Co., B. F.
Swenson Evaporator Co.
Thermo Electric Instrument Co.
Vulcan Iron Works

Drying Trays
Corning Glass Works

Dust Collecting Systems & Engineers
Allis-Chalmers Mfg. Co.
Dust Recovering & Conveying Co.
Hardinge Co.
Holly Pneumatic Systems, Inc.
Raymond Bros. Impact Pulv. Co.
Sturtevant Co., B. F.

Earthenware, Acid Proof
Knight, Maurice A.
U. S. Stoneware Co.

Electrical Supplies
General Electric Co.
Johns-Manville, Inc.
Mine & Smelter Supply Co.

Electroplating, Chromium Cadmium, etc.
Chromium Corp. of America
General Chromium Corp.
United Chromium, Inc.

Electroplating Salts
U. S. Industrial Chem. Co.

Enameled Apparatus, Acid Resisting
Pfaudler Co.

Enamels
Bakelite Corp.
General Plastics, Inc.

Engineers Construction and Engineers, Consulting (Chemical, Analytical, Metallurgical)
Dorr Co.
Fuller Lehigh Co.
Goheen Corp. of N. J.
Southwestern Engineering Corp.
(See Professional Directory)

Engineers, Furnace
Mettler & Co., Lee B.
Rockwell Co., W. S.
Wellman-Seaver-Morgan Co.

Engines, Gas, Gasoline, Oil & Steam
Chicago Pneumatic Tool Co.
Thyle Machinery Co.
Wheeler Mfg. Co.

Ether, Acetic
American Solvents and Chemical Corp'n
U. S. Industrial Chemical Co.

Evaporators
Bethlehem Steel Co.
Blaw-Knox Co.
Buffalo Fdry. & Mch. Co.
Devine Co., J. P.
Joubert & Goslin Co.
Liberty Coppersmithing Co.
Pfaudler Co.
Scott & Co., Ernest
Southwestern Engineering Corp.
Swenson Evaporator Co.
Zaremba Co.

Exhausters, Rotary Positive Gas
Chicago Pneumatic Tool Co.
Connersville Blower Co.
Roots Co., P. H. & F. M.
Sturtevant Co., B. F.

Expansion Joints
E. B. Badger & Sons Co.

Explosives
Hercules Powder Co.

Extraction Plants
American Tool & Machine Co.
Bartlett & Snow Co.
Buffalo Foundry & Machine Co.
Devine Co., J. P.
Fletcher Works
Scott & Co., Ernest
Tolhurst Machine Works

Fans, Standard & Acid Proof
(See Blower, Fan Rotary and Turbines)

Faucets, Valves and Cocks, Stoneware, Acid Proof
Knight, Maurice A.
U. S. Stoneware Co.

Feeders
Fuller Lehigh Co.
Jeffrey Mfg. Co.
Schaffer Poidmeter Co.
Standard Conveyor Co.

Ferro Alloys
(See Alloys, Ferrous)

Fillers
American Tripoli Co.

Filling Machinery
Alsop Engineering Co.

Filter Aids
Celite Products Co.
Darco Sales Corp'n
Palo Co.
Sargent & Co., E. H.

Filter Cloth, Metallic
Buffalo Wire Wks.
Cleveland Wire Cloth & Mfg. Corp.
Newark Wire Cloth Co.
United Filters Corp'n

Filter Cloth, Textile
Shriver & Co., T.
United Filters Corp'n

Filter Paper and Mass
Johns-Manville, Inc.

Filter Press Plates, Iron, Wood
Hauser-Stander Tank Co.
Shriver & Co., T.
Perrin & Co., Wm. R.
Sperry & Co., D. R.
United Filters Corp'n

Filter Presses
Oliver Continuous Filter Co.
Perrin & Co., Wm. R.
Shriver, T. & Co.
Sperry & Co., D. R.
United Filters Corp'n

Filter Presses, Laboratory
Perrin & Co., Wm. R.
Shriver & Co., T.
United Filters Corp'n

Filters, Air
Holly Pneumatic Systems, Inc.
Laughlin Filters Co.

Filters, Clarifying
Laughlin Filters Co.
Shriver & Co., T.
United Filters Corp.

Filters, Oil
Bowser & Co., S. F.

Filters, Rotary
Laughlin Filters Co.
Oliver Filter Co.
United Filters Corp'n

Filters, Suction, Acid Proof
Knight, Maurice A.
Oliver Continuous Filter Co.
United Filters Corp'n
U. S. Stoneware Co.

Fire Clay
Armstrong Cork & Insulation Co.
Carborundum Co.
Celite Products Co.
General Refractories Co.

Flanges
Stockham Pipe & Fittings Co.

Flexible Couplings
James Mfg. Co., D. O.

Flooring, Industrial, Ventilating, Fireproof, Non-Slipping
Hendrick Mfg. Co.
Irving Iron Works Co.
Johns-Manville, Inc.

Forgings
International Nickel Co.
Moore Drop Forging Co.

Furnaces
Ajax Electrothermic Corp.
Combustion Engineering Corp.

Furnaces, Electric
Ajax Electrothermic Corp.
General Electric Co.
Hevi-Duty Electric Co.
Hoskins Mfg. Co.
National Electric Heating Co.
Rockwell Co., W. S.

Furnaces, Industrial
Nichols Copper Co.

Furnaces, Laboratory
Nichols Copper Co.
Pacific Foundry Co.

Furnaces & Accessories, Industrial (Assay Melting, Caustic Pots, Electric, Heat Treating, Oil Gas & Coke, Muffle, Porcelain-Enameling, Roasting, and Smelting)
Ajax Electrothermic Corp.
Allis-Chalmers Mfg. Co
Best Corporation, W. N.
Braun Corporation
Braun-Knecht-Heimann Co.
Buffalo Dental Mfg. Co.
Denver Fire Clay Co.
Hevi-Duty Electric Co.
Hoskins Mfg. Co.
Nichols Copper Co.
Pacific Foundry Co.
Palo Co.
Quigley Furnace Specialties Co.
Rockwell Co., W. S.
Sargent & Co., E. H.

Fusel Oil
American Solvents & Chemical Corp'n
U. S. Industrial Chem. Co.

Gages, Recording and Indicating, Pressure, Vacuum and Liquid Level
Amer. Schaffer & Budenberg Corp.
Bailey Meter Co.
Bristol Company
Brown Instrument Co.
Republic Flow Meters Co.

Gas Analysis Instruments
Republic Flow Meters Co.

Gas Holders
Chicago Bridge Iron Works

Gas, Nitrogen & Oxygen
International Oxygen Co.

Gas Plant Equipment
Biggs Boiler Works Co.
Koppers Construction Co.

Gas Producers
Duff Patents Co.
Koppers Construction Co.
Morgan Construction Co.
Wellman-Seaver-Morgan Co.

Gaskets & Packing Rings
Garlock Packing Co
Johns-Manville, Inc.

Gauges, Recording and Indicating

Gauges, Welding
Oxweld Acetylene Co.

Gear Cutting
Foote Bros. Gear & Machine Co.
James Mfg. Co., D. O.
Jones Foundry &Mch. Co.
Palmer-Bee Co.

Gears, Compensating, Herringbone, Worm, etc.
Foote Bros. Gear & Machine Co.
Horsburgh-Scot Co.
James Mfg. Co., D. O.
Jeffrey Mfg. Co.
Jones Fdry. & Mach. Co.
Mine & Smelter Supply Co.
Palmer-Bee Co.
Philadelphia Gear Works
Vulcan Iron Works
Wellman-Seaver-Morgan Co.

Generators, Acetylene
Oxweld Acetylene Co.

Generators, Electric
Lincoln Electric Co.

Glass, Tank Blocks
Corning Glass Works

Glassware, Laboratory
Corning Glass Works

Glassware, Industrial
Corning Glass Works

Graders, Gyratory & Vibrating
(See Screens, Inclined, Vibratory, Gyratory, etc.)

Graphite
Dixon Crucible Co.

Gratings & Ventilators, Area, Sidewalk, Floor, etc., Metallic
Blaw-Knox Co.
Hendrick Mfg. Co.

Grinding Mills & Pulverizers
(See Crushers, Grinding Mills and Pulverizers)

Hard Rubber Products
American Hard Rubber Co.
Goodrich Rubber Co., B. F.

Heat Exchange Apparatus
Wheeler Mfg. Co.

Heating Elements, Electrical
Globar Co.
Heat Transfer Products, Inc.
Hoskins Mfg. Co.
National Electric Heating Co.

Heating Systems & Accessories
Fulton Sylphon Co.
Globar Co.
Heat Transfer Products, Inc.
Mettler & Co., Lee B.
National Electric Heating Co.
Parks-Cramer Co.
Sturtevant Co., B. F.

Hoists
Caldwell & Son Co., H. W.
Chicago Pneumatic Tool Co.
General Electric Co.
Shepard Electric Crane & Hoist Co.
Sullivan Machinery Co.
Vulcan Iron Works
Wellman-Seaver-Morgan Co.

Hose
Chicago Pneumatic Tool Co.

Hydro-Extractors
(See Centrifugals)

Industrial Coatings
Goheen Corp. of N. J.

Industrial Heat, Gas
American Gas Ass'n
Mettler, Lee B.

Industrial Plant Sites
Industrial Bureau of Atlanta

Instruments, Testing
Bausch & Lomb Optical Co.
Bristol Co., The
Brown Instrument Co.
Weston Electrical Instrument Co.

Insulating Material, Heat, Electric & Molded
Armstrong Cork & Insulation Co.
Bakelite Corp.
Celite Products Co.
General Plastics, Inc.
Corning Glass Works
General Plastics, Inc.
Isolantite Co. of America

Insulators, Electrolytic Cell
Corning Glass Works

Insulation, Furnace
Armstrong Cork & Insulation Co.
Bartley Crucible Co.
Carborundum Co.
Celite Products Co.
Dixon Crucible Co.

Iron, Malleable
Walworth Co.

Iron, Stainless
Allegheny Steel Co.
Bethlehem Steel Co.
Central Alloy Steel Co.

Jars or Storage Pots, Acid Proof
(See Chemical Stoneware, Acid Proof)

Jigs, Coal
Hardinge Co.

Kettles, Cast Iron
Bethlehehm Fdy. & Machine Co.
Buffalo Fdy. & Vacuum Machy. Co.
Pacific Foundry Co.
Sperry & Co., D. R.

Kettles, Lead Coated
Biggs Boiler Works Co.

Kettles, Steam-Jacketed
Bethlehem Fdy. & Machine Co.
Biggs Boiler Works Co.
Blaw-Knox Co.
Buffalo Fdy. & Machine Co.
Koven & Bro., L. O.
Pfaudler Co.
Smith Corp., A. O.
Sperry & Co., D. R.

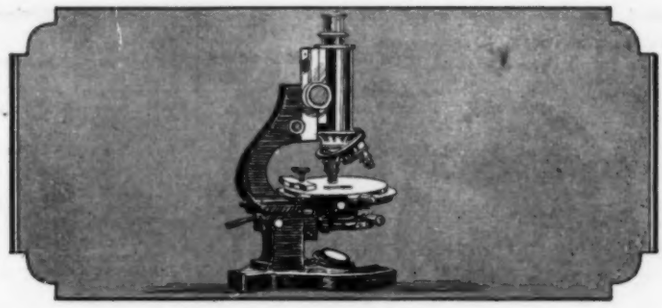
Kettles, Stoneware
Knight, Maurice A.
U. S. Stoneware Co.

Kettles, Varnish
Blaw-Knox Co.
Buffalo Fdy. & Machine Co.

Kilns, Rotary and Vertical
Bartlett & Snow Co., C. O.
Biggs Boiler Works Co.
Blaw-Knox Co.
Ruggles-Coles Eng. Co.
Vulcan Iron Works

Laboratory App. and Supplies
Alberene Stone Co.
Braun Corporation
Braun-Knecht-Heimann Co.
Buffalo Dental Mfg. Co.
Corning Glass Works
Denver Fire Clay Co.
McDanel Refractory Porcelain Co.
Mine & Smelter Supply Co.
Palo Co.
Sargent & Co., E. H.
Thermo Electric Instrument Co.
Tolhurst Machine Works

Laboratory Furniture
Kewaunee Mfg. Co.
Mine & Smelter Supply Co.
Peterson & Co., Inc., Leonard



Putting Industry under the Microscope

CHEMICO LEADERSHIP

First to promote large-scale use of Acid Proof Cement. First to build Acid Concentrating Towers without metal casings. First to build Nitric Acid Absorption and Recovery Towers without Stoneware or metal casings. First to bring Sludge Acid Recovery up to 95% or more; at half the former cost of operation. First to introduce the Krause Disk Spray Drying Process. First to introduce the exclusive "whirlwind" spiral type of Packing Ring—etc.

CHEMICO (an organization of affiliated chemical, electro-chemical and construction engineers) has designed, built and put into operation many of the most successful plants in this country and abroad for the manufacture and recovery of acids, heavy chemicals, fertilizers, etc.

CHEMICO has also developed processes and apparatus of remarkable efficiency and economy. Many of the best known producers of the industry are included in our clientele.

CHEMICO is prepared to thoroughly analyze any process industry and recommend means of attaining high recoveries, greater output, uniform product and lower manufacturing costs.

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Engineers and Erectors Specializing in Plants for Heavy Chemicals and Complete Fertilizers

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ACIPRUF CONSTRUCTION of:

- Sulphuric Acid Chamber Plants —Intensified Method
- Sulphuric Acid Contact Plants
- Ammonia Oxidation Systems
- Sulphuric Acid Concentrators
- Separated Sludge Acid Concentrators
- Complete Fertilizer Plants
- Phosphoric Acid Concentrators
- Double Super Phosphate Plants
- Nitric Acid Plants
- Nitric Acid Absorption Towers
- Nitric Acid Recovery Plants
- Nitric Acid High Concentrators
- Hydrochloric Acid Plants
- Denitration of Spent Acid
- Waste Gas Recovery Plants
- Spent Acid Recovery Plants
- Acid-Proof Masonry Absorption Towers
- In general, all types of Chemical Plants.

CHEMICO

TRADE MARK REG.

CHEMICAL PLANTS—CHEMICAL PROCESSES

Lacing, Belt
(See Belt Lacing)

Lead Burning
Abernethy, John F.
Niagara Blower Co.
Oxweld Acetylene Co.

Lifts, Air
Chicago Pneumatic Tool Co.
Sullivan Machinery Co.
Wheeler Mfg. Co.

Lightning Rods, Chimney
Custodis Chimney Co., Alphons

Lime Chemical and Hydrated
Hunkins-Willis Lime & Cement Co.
Louisville Cement Co.
Marblehead Lime Co.

Loaders & Unloaders, Portable
Jeffrey Mfg. Co.

Locomotives, Industrial Compressed Air
Vulcan Iron Wks.

Locomotives, Industrial, Electric
General Electric Co.
Jeffrey Mfg. Co.
Vulcan Iron Wks.

Locomotives, Industrial, Gasoline
Vulcan Iron Wks.

Locomotives, Industrial, Steam
Vulcan Iron Wks.

Lubricators, Force Feed
Bowser & Co., S. F.

Machinery, Agitating
Alsop Engineering Co.
Bartlett & Snow Co.
Biggs Boiler Works Co.
Blaw-Knox Co.
Buffalo Foundry & Machine Co.
Chemical Equipment Mfg. Corp.
Dorr Co.
Guild & Garrison, Inc.
Mixing Equipment Co.
Pacific Tank & Pipe Co.

Machinery, Coal Handling
(See Material Handling Equipment)

Machinery, Conveying and Elevating
(See Conveying Machinery and Equipment)
Allis-Chalmers Mfg. Co.
Bartlett & Snow Co.
Braun-Knecht-Heimann Co.
Caldwell & Son Co., H. W.
Erie City Iron Works
Fuller Lehigh Co.
Gay Co., Rubert M.
Jeffrey Mfg. Co.
Kent Mill Co.
Raymond Bros. Impact Pulv. Co.
Robinson Mfg. Co.
Swenson Evaporator Co.

Machinery, Crushing, Grinding, and Pulverizer
Bethlehem Steel Co.
Fuller Lehigh Co.
Hardinge Co.
La Bour Co.
Mine & Smelter Supply Co.
Smith Engineering Works
Williams Pat. Crusher & Pulv. Co.

Machinery, Drying
(See Drying Machinery)

Machinery, Emulsifying
Premier Mill Co.

Machinery, Homogenizing
Premier Mill Co.

Machinery, Material Handling
Bartlett & Snow Co.
Caldwell & Son Co., H. W.
Combustion Engineering Corp.
Jeffrey Mfg. Co.
Koppers Construction Co.
Shepard Electric Crane & Hoist Co.
Standard Conveyor Co.
Wellman-Seaver-Morgan Co.

Machinery, Mixing and Kneading
Alsop Engineering Co.
Baker, Perkins Co., Inc.
Bartlett & Snow Co.
Biggs Boiler Works Co.
Fuller-Lehigh Co.
Koven & Bro., L. O.
Mixing Equipment Co.
Robinson Mfg. Co.
Ruggles-Coles Eng. Co.
Smith Engineering Works
Standard Sand & Machine Co.
Stokes Machine Co., F. J.

Machinery, Paint, Varnish & Lacquer
Premier Mill Co.

Machinery, Screening
Hardinge Co.
Jeffrey Mfg. Co.
Kent Mill Co.
Southwestern Engineering

Machinery, Special
Biggs Boiler Works Co.
Blaw-Knox Co.
Guild & Garrison, Inc.
Premier Mill Co.
Proctor & Schwartz, Inc.
Thyle Machinery Co.
Wellman-Seaver-Morgan Co.

Machinery, Thickening & Dewatering
American Tool & Mach. Co.
Dorr Co.
Hardinge Co.
Oliver Continuous Filter Co.
Thyle Machinery Co.
Tolhurst Machine Works
United Filters Corp'n

Machinery, Transmission
(See Transmission Equipment)

Machinery, Weighing
Herrick Scale Co.

Magnetic Separators
Ding's Magnetic Separator Co.

Manganese Metal & Thermit Co.

Material Handling Equip't.
(See Machinery, Material Handling)

Metal Coating and Plating
Chromium Corp. of America
General Chromium Corp.
United Chromium, Inc.

Metallegranbie Equipment
Bausch & Lomb Optical Co.

Microscopes
Bausch & Lomb Optical Co.

Meters, Flow, Air, Gas Steam, Water, Coal
Bailey Meter Co.
Connersville Blower Co.
General Electric Co.
Republic Flow Meters Co.

Mills, Attrition, Ball, Pebble and Tube
Hardinge Co.
Robinson Mfg. Co.
Southwestern Engineering Corp.

Mixers
(See Machinery, Mixing & Kneading)

Motors, Electric
Century Electric Co.
General Electric Co.
Lincoln Electric Co.
Mine & Smelter Supply Co.
Wagner Electric Corp.

Muffles
Carborundum Co.
Denver Fire Clay Co.

Naval Stores
Hercules Powder Co.

Nickel
Nichols Copper Co.

Nitrators
Bethlehem Fdy. & Mach. Co.
Blaw-Knox Co.
Buffalo Fdy. & Machine Co.
Tolhurst Machine Works

Nitrocellulose (Soluble, Bronzing & Lacquer Cotton)
Hercules Powder Co.

Nitrogen
International Oxygen Co.
Linde Air Products Co.

Nozzles, Spray
Chicago Pneumatic Tool Co.
Hardinge Co.
Isolantite Co. of America
Monarch Mfg. Works
Spray Eng. Co.

Oil Burning Systems
Bethlehem Steel Co.

Oil Circulating Systems
Parks-Cramer Co.

Oil Engines, Diesel
Bethlehem Steel Co.
Chicago Pneumatic Tool Co.

Oil Storage Systems
Bowser & Co., S. F.

Oils
Hercules Powder Co.

Ovens, Electric, Laboratory
Thermo Electric Instrument Co.

Ovens, Industrial
General Electric Co.
Koppers Co.
Thermo Electric Instrument Co.

Oxy-Acetylene Apparatus
Oxweld Acetylene Co.

Oxygen Gas
International Oxygen Co.
Kansas City Oxygen Gas Co.
Linde Air Products Co.

Packing, Asbestos, Flax, Rubber, Metallic
Garlock Packing Co.
Isolantite Co. of America
Johns-Manville, Inc.

Packing, Metal
Garlock Packing Co.

Paint & Varnish, Industrial
Dixon Crucible Co.
Goheen Corp. of N. J.
Quigley Furnace Specialties Co.

Paint, Varnish and Lacquer Machinery
Bowser & Co., S. F.

Panel Boards
Republic Flow Meters Co.

Pans, Vacuum
(See Crystallizing Equipment)

Perforated Metals
Chicago Perforating Co.
Hendricks Mfg. Co.

Pipe Covering, Fittings, etc., Wood
Wyckoff & Son Co., A.

Pipe, Silica Ware
Roots Co., P. H. & F. M.

Pipe, Wood
Pacific Tank & Pipe Co.

Pipe & Fittings, Brass
Walworth Co.

Pipe and Fittings, Cast Iron
National Pipe Bending Co.
Pacific Foundry Co.
Stockham Pipe & Fittings Co.
U. S. Cast Iron Pipe & Foundry Co.
Walworth Co.

Pipe & Fittings, Drainage
Stockham Pipe & Fittings Co.

Pipe & Fittings, Glass
Corning Glass Works

Pipe & Fittings, Lined with Lead, Tin, Brass, Etc.
Abernethy, John F.
Lead Lined Iron Pipe Co.
Niagara Blower Co.
United Lead Co.
Walworth Co.

Pipe & Fittings, Malleable
Stockham Pipe & Fittings Co.

Pipe & Fittings, Metal, Acid Proof
Allegheny Steel Co.
Duriron Co., The
International Nickel Co.
Merco Nordstrom Valve Co.
Nilson-Miller Co.
Pacific Foundry Co.

Pipe & Fittings, Rubber Lined
American Hard Rubber Co.
Goodrich Rubber Co., B. F.

Pipe & Fittings, Stoneware, Acid Proof
(See Chemical Stoneware, Acid Proof)

Pipe Covering, Fittings, etc.,
Armstrong Cork & Insulation Co.
Johns-Manville, Inc.

Pipe, Riveted and Welded
Biggs Boiler Works Co.

Pipe, Silica Ware
Thermal Syndicate, Ltd.

Piping Jacketed
Parks-Cramer Co.

Plates, Porous
Norton Co., The

Platinum Wire, Sheet, Foil Crucibles, Lab. Ware.
American Platinum Works
Baker & Co., Inc.
Bishop & Co. Platinum Wks.

Porcelain Grinding Balls
McDanel Refractory Porcelain Co.

Porcelain Linings
McDanel Refractory Porcelain Co.

Pottery, Acid Proof
Knight, Maurice A.
U. S. Stoneware Co.

Powdered Coal Equipment
Fuller Lehigh Co.
Hardinge Co.

Power Plant Equipment
Biggs Boiler Works Co.
Bristol Company, The
Chicago Pneumatic Tool Co
Fuller Lehigh Co.
General Electric Co.
Heat Transfer Products, Inc.
Jeffrey Mfg. Co.
Walworth Co.
Williams Pat. Crusher & Pulv. Co.

Power Transmission Equipment
(See Transmission Equipment)

Precipitation, Electrical
Western Precipitation Co.

Presses, Hydraulic
Perrin & Co., Wm. B.
Southwork Fdry. & Mach. Co.
Watson-Stillman Co.
Wellman-Seaver-Morgan Co.

Pthalate, Alcohol
Commercial Solvents Corp'n

Pulleys
Fuller Lehigh Co.

Pulleys, Magnetic
Ding's Magnetic Separator Co.

Pulverized Coal Equipment
Caldwell & Son Co., H. W.
Fuller Lehigh Co.
Hardinge Co.
Kent Mill Co.
Raymond Bros. Impact P. Co.
Swenson Evaporator Co.
Williams Pat. Crusher & Pulv. Co.

Pulverizers, Ore
(See Machinery, Crushing, Grinding and Pulverizing)

Pumps, Acid Proof
American Well Works
Blackmer Pump Co.
Buffalo Forge Co.
Chemical Equipment Mfg. Corp.
Chicago Pump Co.
Goulds Pumps, Inc.
La Bour Co.
Nilson-Miller Co.
Oliver Continuous Filter Co.
Shriver & Co., T.
Taber Pump Co.
United Lead Co.

Pumps, Air Lift
(See Lifts, Air)

Pumps, Automatic Sump
Goulds Pumps, Inc.

Pumps, Centrifugal
American Well Works
Bethlehem Steel Co.
Chicago Pump Co.
De Laval Steam Turbine Co.
Duriron Co.
Goulds Pumps, Inc.
Krogh Pump & Machinery Co.
La Bour Co.
Mine & Smelter Supply Co.
Oliver Continuous Filter Co.
Taber Pump Co.
Wilfley & Sons, A. R.

Pumps, Deep Well
Goulds Pumps, Inc.

Pumps, Portable
Alsop Engineering Co.
Goulds Pumps, Inc.

Pumps, Rotary
Blackmer Pump Co.
Chicago Pneumatic Tool Co.
Connersville Blower Co.
Goulds Pumps, Inc.
Taber Pump Co.
Wilfley & Sons, A. R.

Pumps, Sand, Slime and Tailings
Krogh Pump & Machy. Co.
Mine & Smelter Supply Co.
Wilfley & Sons, A. R.

Pumps, Self Measuring
Bowser & Co., S. F.

Pumps, Steam
De Laval Steam Turbine Co.
Guild & Garrison, Inc.
Watson-Stillman Co.

Pumps, Triplex
Goulds Pumps, Inc.

Pumps, Vacuum
Buffalo Fdry. & Mch. Co.
Chicago Pneumatic Tool Co.
Chicago Pump Co.
Connersville Blower Co.
Devine Co., J. P.
Goulds Pumps, Inc.
Guild & Garrison, Inc.
Oliver Continuous Filter Co.
Sullivan Machinery Co.
Wheeler Mfg. Co.

Pyrometer Protection Tubes
Bristol Company, The
Carborundum Co.
McDanel Refractory Porcelain Co.
Republic Flow Meters Co.
Roots Co., P. H. & F. M.
Thermal Syndicate, Ltd.

Pyrometers
Bristol Co., The Inc.
Brown Instrument Co.
Hoskins Mfg. Co.
Pyrometer Instrument Co.

Reclaiming Systems, Oil
Bowser & Co., S. F.

Recorders, CO_2
Republic Flow Meters Co.

Recorders, Specific Gravity
Bailey Meter Co.

Recording Instruments
Amer. Schaeffer & Budenberg Corp.
Bailey Meter Co.
Bristol Co., The
Republic Flow Meters Co.

Recuperators
Blaw-Knox Co.
Smith Corp., A. O.

Reels, Sifting
Robinson Mfg. Co.

Refractories
Bartley Crucible Co.
Carborundum Co.
General Refractories Co.
Johns-Manville, Inc.
McDanel Refractory Porcelain Co.
Quigley Furnace Specialties Co.
Roots Co., P. H. & F. M.

Refractometers
Bausch & Lomb Optical Co.

Refractory Brick Work
Chemical Appliances, Inc.
Custodis Chimney Co.

Regulators, Pressure and Temperature
Bristol Company, The
Fulton Syphon Co.
General Electric Co.
Mason Regulator Co.
National Electric Heating Co.
Powers Regulator Co.

Regulators, Welding & Compressed Air
Oxweld Acetylene Co.

Resistors, Electrical
Hoskins Mfg. Co.

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Gay Co., Rubert M.
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Southwestern Engineering Corp.

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Cleveland Wire Cloth & Mfg. Co.
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Consolidated Products Corp.
Du Pont de Nemours Co., E. I.
Equipment Sales Co.
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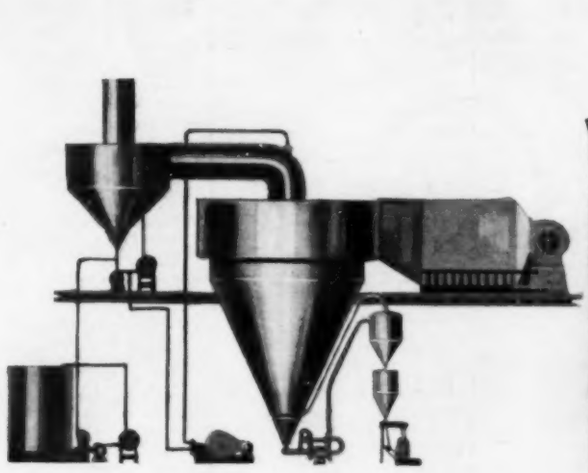
Kehoe, Robt. P.



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Stein Brill Co.
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United Utilities, Inc.

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Hardinge Co.
Kent Mill Co.
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Fletcher Works
Gay Co., Rubert M.
Tolhurst Machine Works

Separators, Inclined Vibratory, etc.
(See Screens, Inclined, Vibratory, Gyratory, etc.)

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Allegheny Steel Co.

Sheets, Rubber Lined
Goodrich Rubber Co., B. F.

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Williams Pat. Crusher & Pulv. Co.

Sieves, Laboratory
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(See Screens, Inclined, Vibratory, Gyratory, etc.)

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Soda, Bicarbonate of
Diamond Alkali Co.

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Berg Industrial Alcohol Co., David
Carbide & Carbon Chemical Corp.
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Bowser & Co., S. F.

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(See Nozzles, Spray)

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Hendrick Mfg. Co.
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Duff Patents Co.
Sheet Steel Trade Ext.
Smith Corp., A. O.

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Chemical Equipment Mfg. Corp.

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Goodrich Rubber Co., B. F.
Hauser-Stander Tank Co.
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(See Chemical Stoneware, Acid Proof)

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Hauser-Stander Tank Co.
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Bailey Meter Co.
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(See Machinery, Thickening and Dewatering)

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U. S. Stoneware Co.

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Knight, Maurice A.
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Tripoli
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Corning Glass Works

Tubes, Silica
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Chrome Alloy Tube Corp.

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(See Stoneware, Chemical, etc.)

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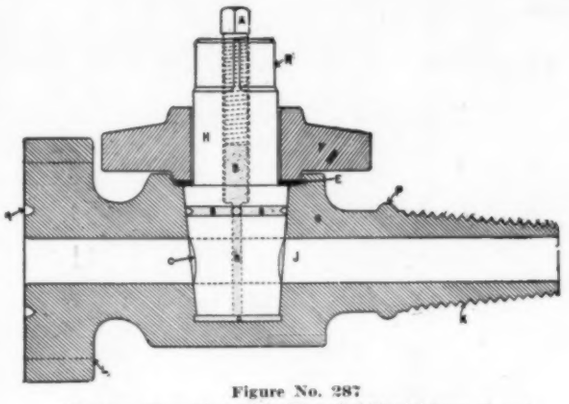

Figure No. 287
Phantom View Flanged to Threaded Straightway Faucet

Figure No. 289

COMPONENT PARTS OF KNIGHT-MERCO LUBRICATED PLUG VALVE

Showing Plain Shank Bib Faucet Design

A—Bowl or main body of faucet.
B—Plain shank for grinding into outlets.
C—Bib design of faucet.
D—Collar.
E—Square shank for use of wrench in turning.
F—Plug or key of faucet showing grease ducts and slots.
G—Asbestos ring packing for collar.
H—Monel "U" shaped bar for assembling faucet.
J—Monel washers.
K—Monel wing nuts or plain nuts as wanted.
L—Compression screw for forcing grease into grease well.

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Maurice A. Knight
Akron, Ohio

Figure No. 290
Threaded Bib Faucet with Hooded Key and Dripless Body

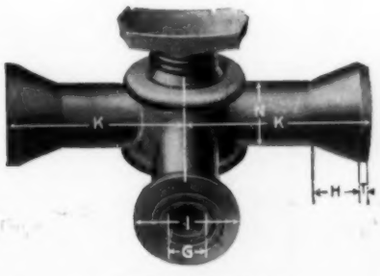


Figure No. 303
Conical Flanged 3-Way Valve

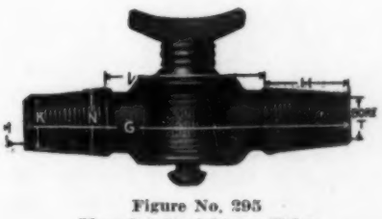
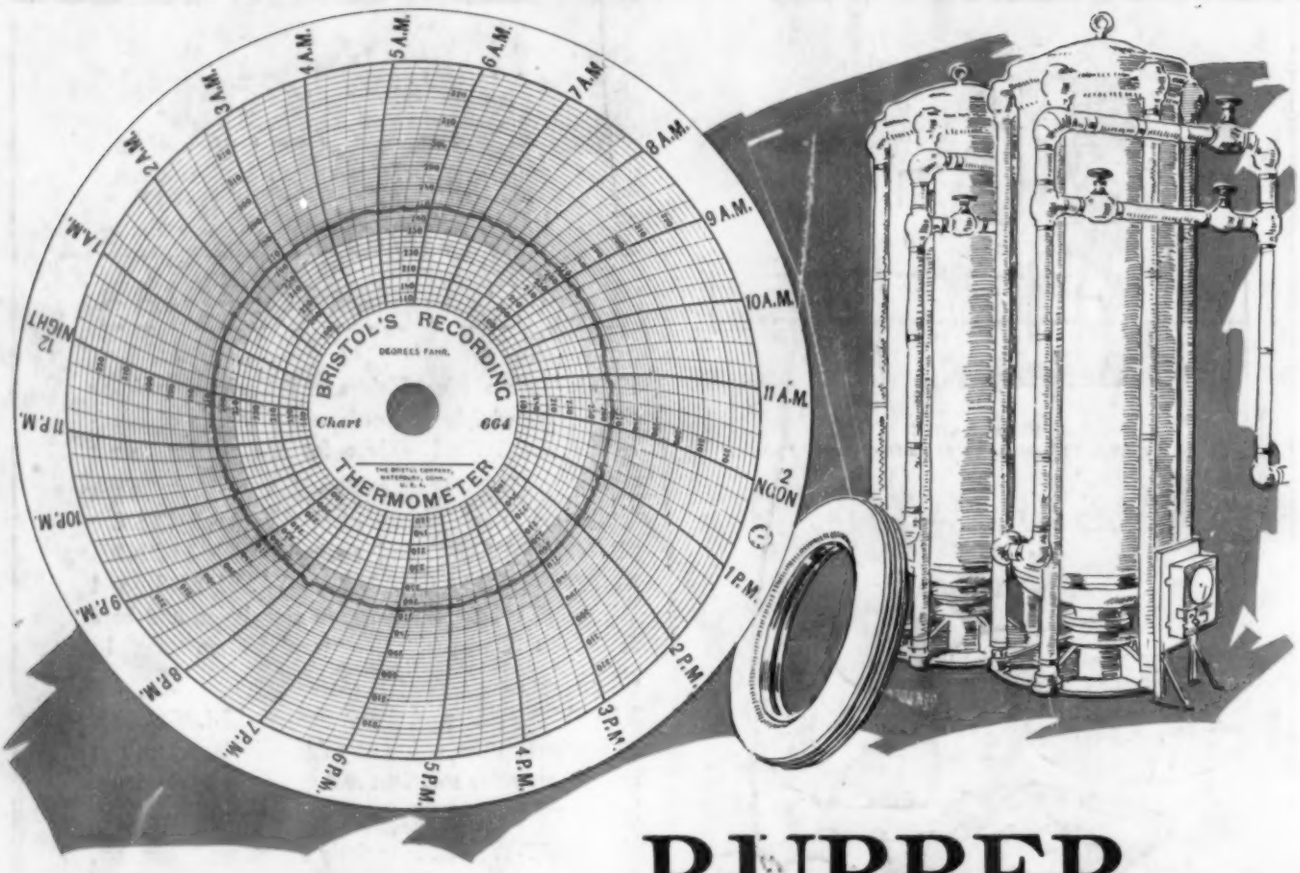


Figure No. 295
Threaded Straightway Valve



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